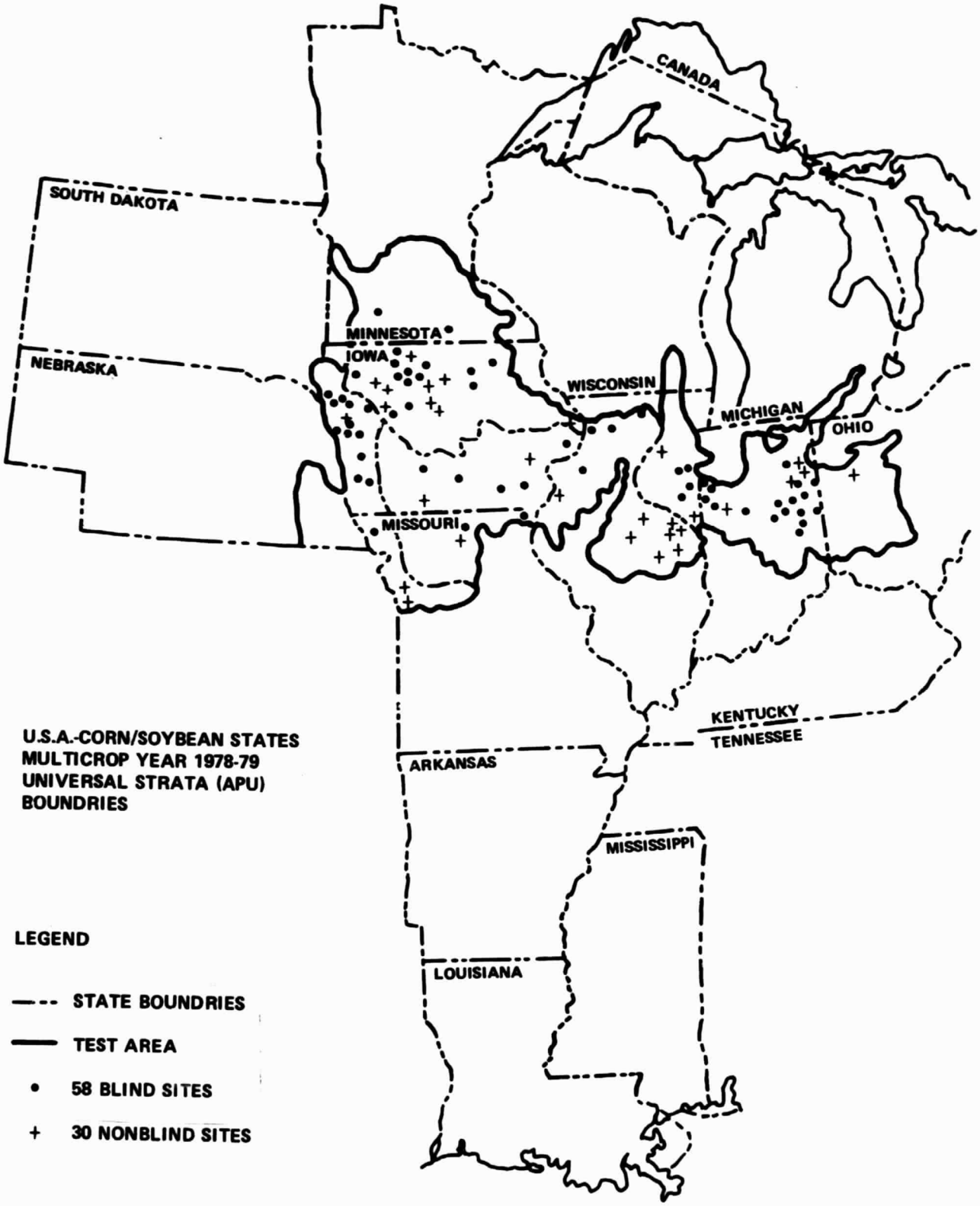
SIMULATED AGGREGATION TEST



C-2

AgRISTARS

FC-JO-00507 E82-10039
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~~CR-161044~~ TM-84050

A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

Foreign Commodity Production Forecasting

SEPTEMBER 24, 1980

MINUTES OF THE
SEMI-ANNUAL FORMAL PROJECT MANAGER'S REVIEW
INCLUDING
PRELIMINARY TECHNICAL REVIEW REPORTS OF FY80 EXPERIMENTS

NASA ~~CR-161044~~/
TM-84050

(E82-10039) AGRISTARS: FOREIGN COMMODITY PRODUCTION FORECASTING. MINUTES OF THE ANNUAL FORMAL PROJECT MANAGER'S REVIEW INCLUDING PRELIMINARY TECHNICAL REVIEW REPORTS OF FY80 EXPERIMENTS (NASA) 191 p HC A09/MF A01 G3/43 00039

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Lyndon B. Johnson Space Center
Houston, Texas 77058

This report documents the minutes of the planned "Preliminary Technical Review Report (PTRR) and the "Semi-annual" formal project manager review of the Foreign Commodity Production Forecasting (FCPF) project. The reviews were held at the Lyndon B. Johnson Space Center on September 24, 1980. Part I represents the PTRR. Part II statuses the remaining project activities. Part I combined with Part II represents the "FCPF Semi-annual Project Manager's Review" meeting minutes and fulfills the FCPF requirements specified in the AgRISTARS Program Plan and Program Management Schedules

James L. Dragg

James L. Dragg
FCPF Project Manager

AgRISTARS

FOREIGN COMMODITY PRODUCTION FORECASTING (FCPF)

Preliminary Technical Review Report (PTRR) SEPTEMBER 24, 1980

AGENDA

AGENDA

FOREIGN COMMODITY PRODUCTION FORECASTING (FCPF)
Semi-Annual Formal Project Manager's Review
Minutes - Crop Region Exploratory Experiments
September 24, 1980

INTRODUCTORY REMARKS - R. O. Hill

This is the first in a series of planned FCPF technical reviews as indicated on the FCPF milestone chart. This meeting agenda outline two major areas to be discussed: U.S./Canadian Wheat/Barley Exploratory and U.S. Corn/Soybean Exploratory.

LABELING EXPERIMENT DISCUSSION - R. M. Bizzell

A vast amount of data has been accumulated. Plans are to identify a number of detailed questions which must be answered next year. This year, emphasis was put on consistency and efficiency in the labeling process. A "Reformatted Procedure" was developed to emphasize objectivity and improve efficiency in the labeling procedure. The hierarchical approach to labeling provides the capability of working estimates at any level. Acquisition selection for "Reformatted Procedure" requires very rigidly defined windows. The spring barley window is pretty tight. With regard to Labeling Experiment/Design, there is one basic procedure, "Reformatted Procedure," which is not in conflict with "Integrated Procedure." Goddard was having trouble with the master data processor, so for 1979, we didn't get the acquisitions desired. R. Bizzell expressed concern about the 60-day purge of the HDDT's. It is something that can be reordered, but it is expensive and time consuming. In North Dakota, the acreage change in sunflowers since 1976 has increased appreciably. This year, we are seeing an increase in winter wheat in the Red River Valley. Labeling error characterizations (9 segments) showed the relative importance of error causes and indicates where the error happened so that what needs to

be worked is known. Trends can be observed from the data shown in the "Integrated Procedure Labeling Error Characterization" of the U.S. Wheat/ Barley Exploratory Experiment - Test 2. These aircraft photos of Burke County, North Dakota, Segment 1394, shows potholes. They start out not red because they are full of water, then dry up and turn red and later they are not red again. Labeling/accuracy is a problem. The major reason for late planting appears to be moisture more than temperature. The Decision Logic Results for Cropland/Non-Cropland show that the "Integrated Procedure" correctly identified non-cropland quite well. In the development of decision logic to augment the "Reformatted Spring Small Grains Labeling Procedures," the automatic procedure gives a faster turn-around in development. If the windows are open, an at-harvest procedure can be developed that will help with the omission errors for pasture. Mid-season procedures are being worked also. In summary, we are ready to go into the U.S./Canada pilot for small grains. We feel that a "Shakedown" test should be accomplished before going into the "Pilot." The procedure is very sensitive to knowing where we are in the growth stages. Crop calendar work has to be continued, the machine classification problem hasn't been addressed, and the pastures and late summer crops issues have to be resolved. There should be a shakedown exploratory this fall to get ready for the pilot. There are some sensitivity studies planned to determine limitations on "broken" windows.

(Attachment 1)

MACHINE PROCESSING - P1A EXPERIMENT RESULTS - D. T. Register

The segment proportion estimation method, P1, had been shown in LACIE Phase III and TY studies to have no greater precision than the simple random sample method. Supporting Research (SR) developed and tested, on a small scale, an improved segment proportion estimation technology

(PIA). Their results were dramatic and SR recommended that a larger scale test be conducted for five weeks. Consequently, as a supplement to the U.S./Canada Wheat/Barley exploratory an evaluation of this technology was conducted. In general, the results of this test did confirm those of SR. However, issues have arisen which precluded a recommendation on machine processing for the 1981 U.S./Canada Wheat/Barley pilot at this time.

(See Attachment 2)

CROP CALENDAR EXPERIMENT RESULTS - C. V. Nazare

During LACIE, Spring Wheat Planting Date and Crop Calendars models based on historical normals were improved by the use of the Feyerherm and Robertson Spring Wheat Crop Calendar models. Modifications were subsequently made by the SR crop calendar task element to the Robertson model to improve deficiencies identified in LACIE evaluations. These modifications were tested along with a state-of-the-art Barley Model (Williams) against a ground truth data-set from 49 segments in the U.S. Great Plains Spring Wheat/Barley region (for the 1979 crop year).

The results indicated that the Feyerherm and Improved Robertson Version 2 models were the most suitable candidates for application to AgRISTARS labeling procedures and, furthermore, that the Williams Barley model was worse than the Robertson Models for predicting Barley Growth Stages.

(Attachment 3)

U.S. Corn/Soybeans Exploratory Experiments

Segment Level Evaluation Results - G. Houston

The labeling and proportion estimation results from the Classification Procedures Verification Test and the follow-on Simulated Aggregation Test

were discussed. The results indicated that the hierarchical decision logic approach produced excellent labeling of pure pixels for corn (93% correctly labeled) and soybeans (88% correctly labeled) with full season Landsat data in the central U.S. corn belt environment. The results also indicate the need for machine processing to more effectively deal with mixed and boundary pixels in order to produce unbiased proportion estimates at the segment level. An outlook statement was presented indicating the anticipation that the machine processing approach being developed and implemented by ERIM for the U.S. Corn/Soybeans Pilot Experiment will effectively deal with the mixed pixel problem in proportion estimation.

(Attachment 4)

SIMULATED AGGREGATION TEST (Large Area Level) - A. Feiveson

It appears that the AgRISTSRS Aggregation Procedure is suitable for implementation in crop/region experiments. We recommend that more sophisticated models be developed before further simulations are undertaken.

(Attachment 5)

SUMMARY COMMENTS - J. Dragg

Preliminary Conclusions From W/B/SG Experiment Test

+ Major Progress
  Accuracy for Spring Small Grains
  Reduction in Labor Intensiveness

+ Continued Problem Areas
  W/B Separability
  Machine Processing
  Early Season

+ Review and Analysis Required
  Firm Up Conclusions
  Make Recommendations

Preliminary Conclusions from C/S Experiment Tests

+ Major Progress
  Labeling
  Sampling/Aggregation

+ Final Recommendations
  Pending Critical Design Review

DATA ACQUISITION/HANDLING/PROCESSING - G. McKain

The 1980 ground inventories have been coming in from the USDA field personnel. All inventories are due by October 15, 1980. The 1981 aircraft/ground data program has been tentatively scoped at the same level as last year (320 segments). Specific segment locations are required by early November. Processing of Landsat 2 through the LACIE processor commenced September 19, 1980, however limited data has been received. Technical problems continue to plague the reinitialization of the LACIE processor for processing Landsat 3 data. Results of the Landsat data quality screening conducted at EDC were presented. It was noted that less than half of the foreign data (Brazil, Australia, Argentina) acquired was backlogged at GSFC and was not available for screening. It was noted that GSFC does not have a schedule for working off this backlog. The planned deliveries of Landsat and other data required to support the seven experiments to be conducted in the 1981-1982 timeframe were discussed. Mr. Rice noted that the plan called for the processing of Landsat data through the LACIE processor through June of 1981, although funding for the LACIE processor terminates in April. Mr. MacDonald stated that we should take our "going in" position with GSFC and should show dates compatible with the funding picture. An action was assigned to SF6 to work this problem with GSFC and to help GSFC develop a "work-off" plan for the LACIE processor which will have a minimum impact upon experiment schedules.

(Attachment 6)

U. S. AGRICULTURE DATA ACQUISITION - D. Frank

Only inventory data was received for the 30 Canadian ground data sites in '78 and '79. There is a possibility that periodic data is being collected over the 10 (2 x 10 mm) test sites, we have not received any of this data since 1978. Periodic data was collected for 65 sites in '79 and 74 sites in '80 in the northern great plains. Requirements and procedures meetings were scheduled with Canadians in the summer of '79 and '80. USDA attended in '79, NASA was requested to attend both meetings, but travel was not approved. A similar meeting is scheduled for '81.

Ground data requirements for 1981 are slipping behind schedule, and could impact significant changes in procedures. Detailed Requirements definitions are needed by November 1, to begin Landsat and aircraft data orders, procedure development, and product support. An issue of concern is that another year is being scoped and very little experience has been gained by most researchers from using the '79 and '80 data sets; more emphasis must be placed on those tasks that require near real time data support.

(Attachment 7)

FOREIGN AGRICULTURE DATA - D. Henninger

The USDA tasks for acquisition of foreign agriculture data have not been initiated by USDA. As a result, FCPF created a team (co-chaired by Henninger/NASA/ and Frank/USDA) to develop plans and carry out tasks to acquire foreign agriculture data for FCPF and SR support to FCPF. Accomplishments include preparation of a detailed crop/region list of foreign agricultural data requirements and an "in-house" data inventory. International cooperative research agreements have been or are being prepared for Brazil, Australia, and Argentina.

(Attachment 8)

METEOROLOGICAL DATA ACQUISITION/PROCESSING - M. Helfert

The known requirements for met data tapes should be at LARS, except the USSR, by the time it is needed. The Canadian data at the moment is probably the best we have access to. We are doubtful that we will get coop data of any quality from Argentina, Australia or Brazil. It is doubtful that 1980 data will be available for USSR until late next year. The 1978 USSR data is here now. The reason for the conflict is that the requirements were not established until September 10, 1980 (daily info) (USSR W/B). Another problem is a matter of processing data to a format we can use. JAWF's first priority are Australia and Argentina. We do not see any way to run '76-'77 met data for the USSR plus every other country except Canada and the US. We recommend running 1 year (1978) and that future requirements be carefully considered and documented. There is no current activity to get a commercial firm to provide met data. It is felt that it will not be any better data than what NOAA can provide. The data should be in tape form

to be useful. Time is the major problem. NOAA has an extensive QA/QC process which is very time consuming. We should get the word as to what we want to Doctors Hock and Hadeen while they are down here next week. If we start now, we might have the met data for the 1982 pilot.

(Attachment 9)

ACCURACY ASSESSMENT METHODOLOGY DEVELOPMENT - G. Houston

The initial procedure (called Maximal Analysis) developed for evaluating segment level labeling and proportion estimation accuracy has been abandoned since initial results were not encouraging. An indirect approach for evaluating segment level performance has been initiated based on modeling omission and commission error rates and proportion estimation error rates as a function of segment level parameters. An initial model is being developed based on P1 results for the 1978 blind site data in the northern Great Plains. A model based on the Reformatted Procedure will be developed using the results of the FY81 US/Canada Wheat/Barley Pilot Experiment for initial application in the USSR Barley Exploratory and Pilot Experiments.

(Attachment 10)

MULTICROP SAMPLING AND AGGREGATION TECHNOLOGY - C. Hallum

There are a number of new key people (Universities, Contractors, etc.) working this year. They are highly capable and are being integrated into the work force.

(Attachment 11)

SAMPLE FRAME DEVELOPMENT - C. Hallum

Sample frame development activities at USDA/ESCS in D.C. in support of AgRISTARS is concentrated in three states in Brazil and two states (N. Carolina & Georgia) in the U.S. These activities are progressing on schedule for a January 1, 1981 delivery to NASA/JSC. In the field spot checks are being conducted to determine the quality of the products being generated. Looks so far indicate that the sample frame development approach is working quite well.

(Attachment 12)

YIELD PROJECT INTERFACE - J. Rogers

The yield estimate requirements chart is laid out in priority order. Brazil corn and soybeans is not done. The yield strata estimates at the CRD level will be delivered April 1, 1981. The Williams and CCEA models will be tested and a selection will be made by March 1, 1981 (for barley).

(Attachment 13)

CLASSIFICATION FOR AREA ESTIMATION - R. Horvath

The Corn and Soybean Classification Technology Development for Area Estimation for FCPF objectives, scope and related programs were recapped Activities, accomplishments and issues are shown in attachment #14.

LABELING DEVELOPMENT RATIONALE

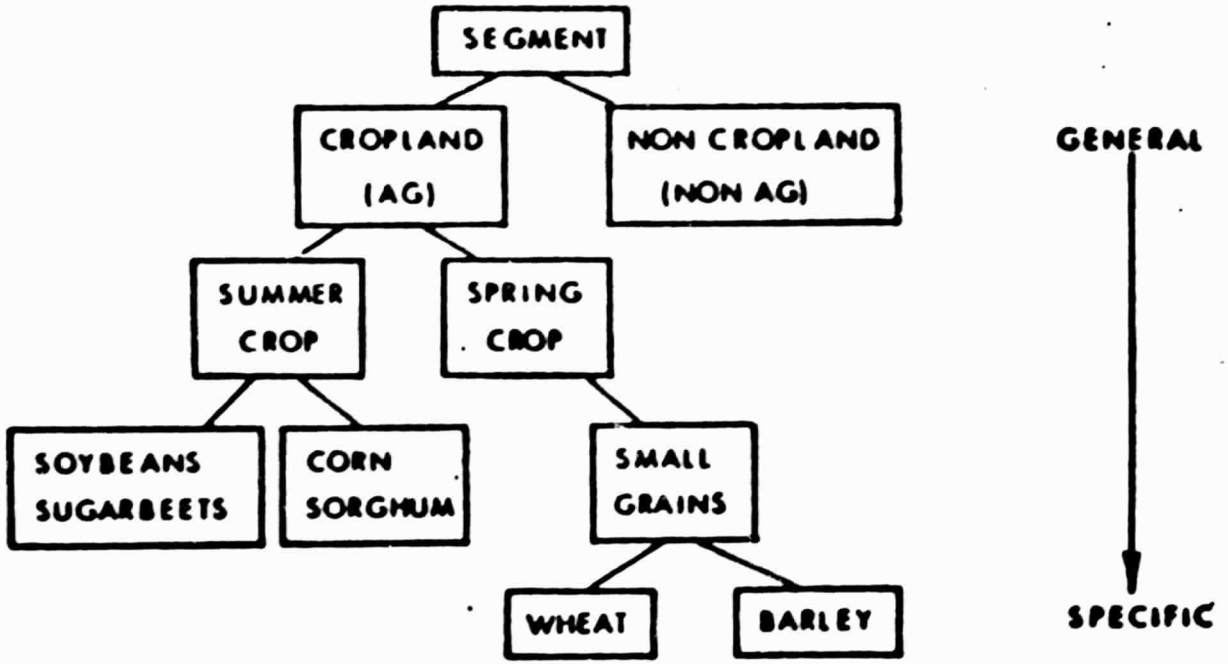
- LABELING IS A SIGNIFICANT, THOUGH ONLY ONE, COMPONENT OF THE AREA ESTIMATION PROCESS
- LABELING DEVELOPMENT IS DRIVEN BY THREE CRITERIA;
  - ACCURACY
  - CONSISTENCY
  - EFFICIENCY
- DUE TO TECHNOLOGY TRANSFER CONSIDERATIONS SIGNIFICANT EMPHASIS IS GIVEN TO THE CONSISTENCY AND EFFICIENCY CRITERIA
- REFORMATTED PROCEDURE WAS DEVELOPED AS THE INITIAL BASELINE PROCEDURE WHICH EMPHASIZED OBJECTIVITY AND THE MODEL FOR LABELING AUTOMATION
- THE INTEGRATED PROCEDURE HAS BEEN CONFIGURED AS A LABELING TOOL TO IMPROVE ACCURACY

Attachment #1

TECHNICAL APPROACH TO LABELING

LACIE – WHEAT VS OTHER

AgRISTARS – HIERARCHICAL MULTICROP APPROACH



#1

HIERICHICAL APPROACH

DECISION TREE

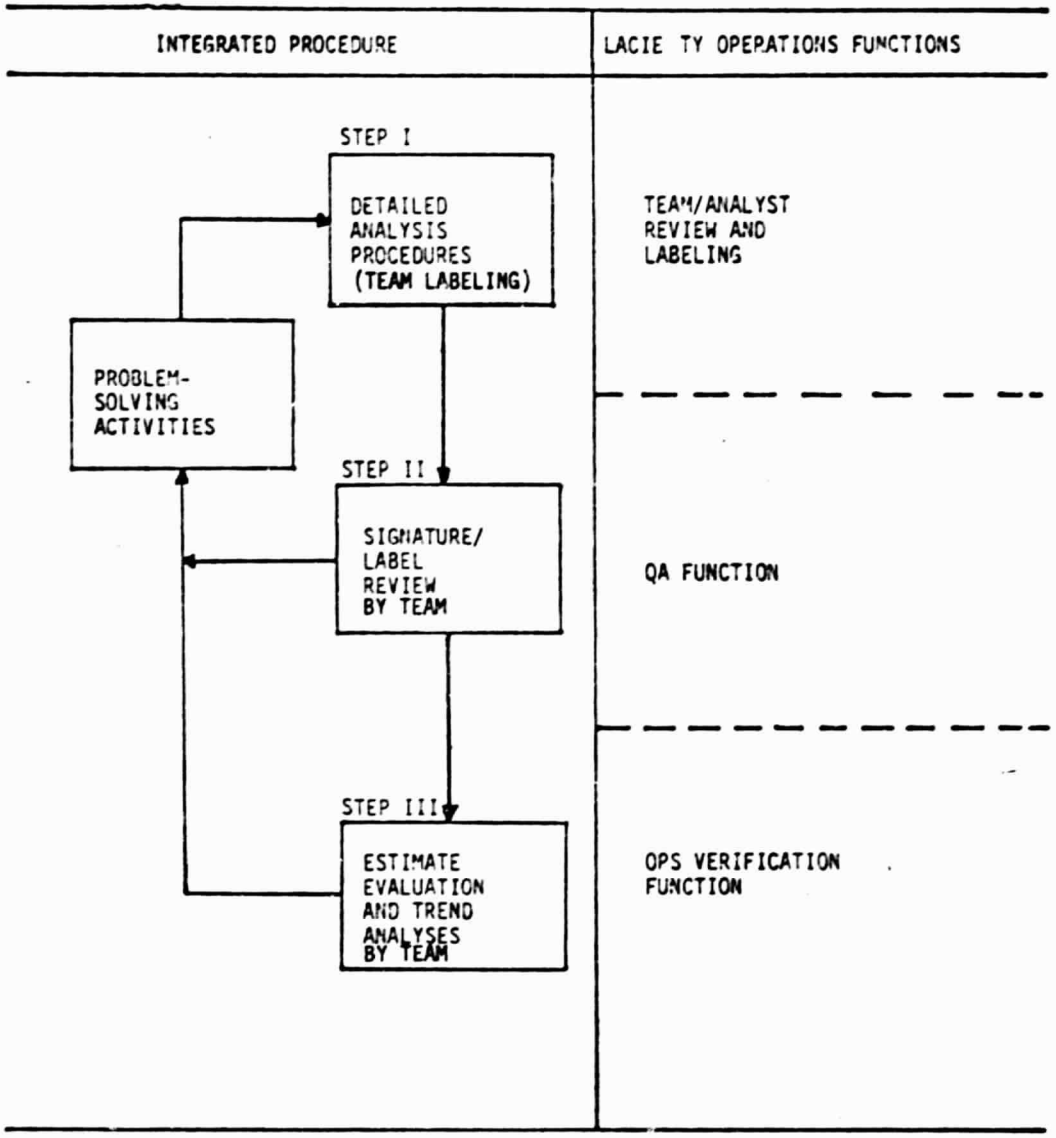
DISADVANTAGES

- PROVIDES POTENTIAL OPPORTUNITY FOR INCREASED ERROR
- IN SOME CASES INCREASES THE ANALYST WORKLOAD

ADVANTAGES

- ESTABLISH BASIS FOR TECHNOLOGY TO PRODUCE ESTIMATES AT LOWER CATEGORY/ CLASS LEVEL
- PROVIDES DATA AT DETAILED COMPONENT LEVELS THAT AIDS IN PROCEDURE EVALUATION AND FURTHER TECHNIQUES DEVELOPMENT

INTEGRATED ANALYSIS PROCEDURE GENERALIZED FUNCTIONAL FLOW



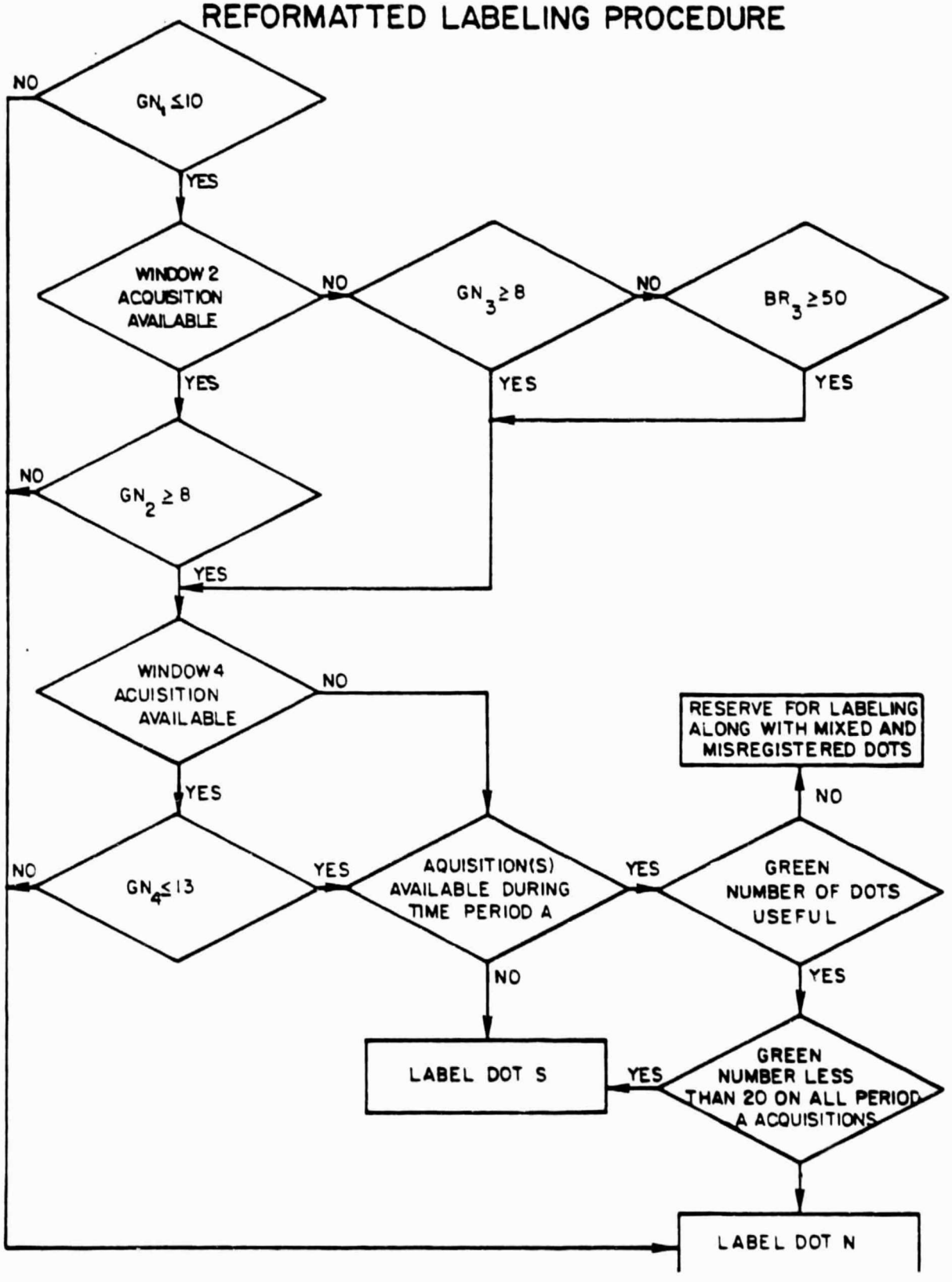
#1

INTEGRATED PROCEDURE

- PROCEDURES DEVELOPMENT STANDARD
- OBJECTIVE LABELING PROCEDURES COMPARED TO INTEGRATED PROCEDURE
  - + IDENTIFY PROCEDURAL STEPS WHICH CAN BE IMPROVED
- ELEMENTS OF INTEGRATED PROCEDURE
  - + TEAM - ORIENTED LABELING
  - + SEGMENT REGIONALIZATION (CLASSIFICATION STRATIFICATION)
  - + QUALITY ASSURANCE BY TEAM MEMBERS
  - + TREND ANALYSES BY TEAM

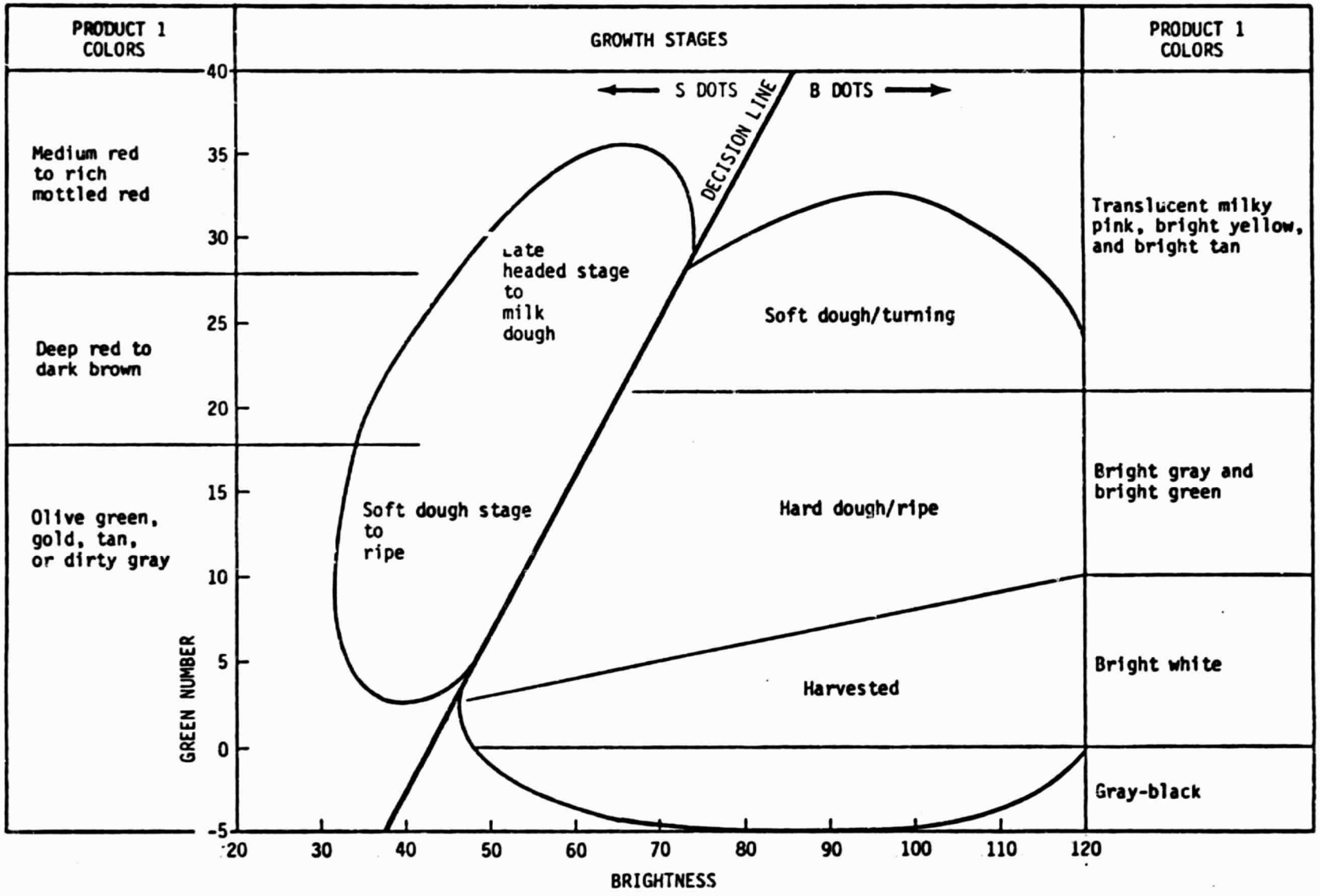
#1

SMALL GRAINS VS NON SMALL GRAINS REFORMATTED LABELING PROCEDURE



SCATTER PLOTS CHARACTERISTICS OF BARLEY

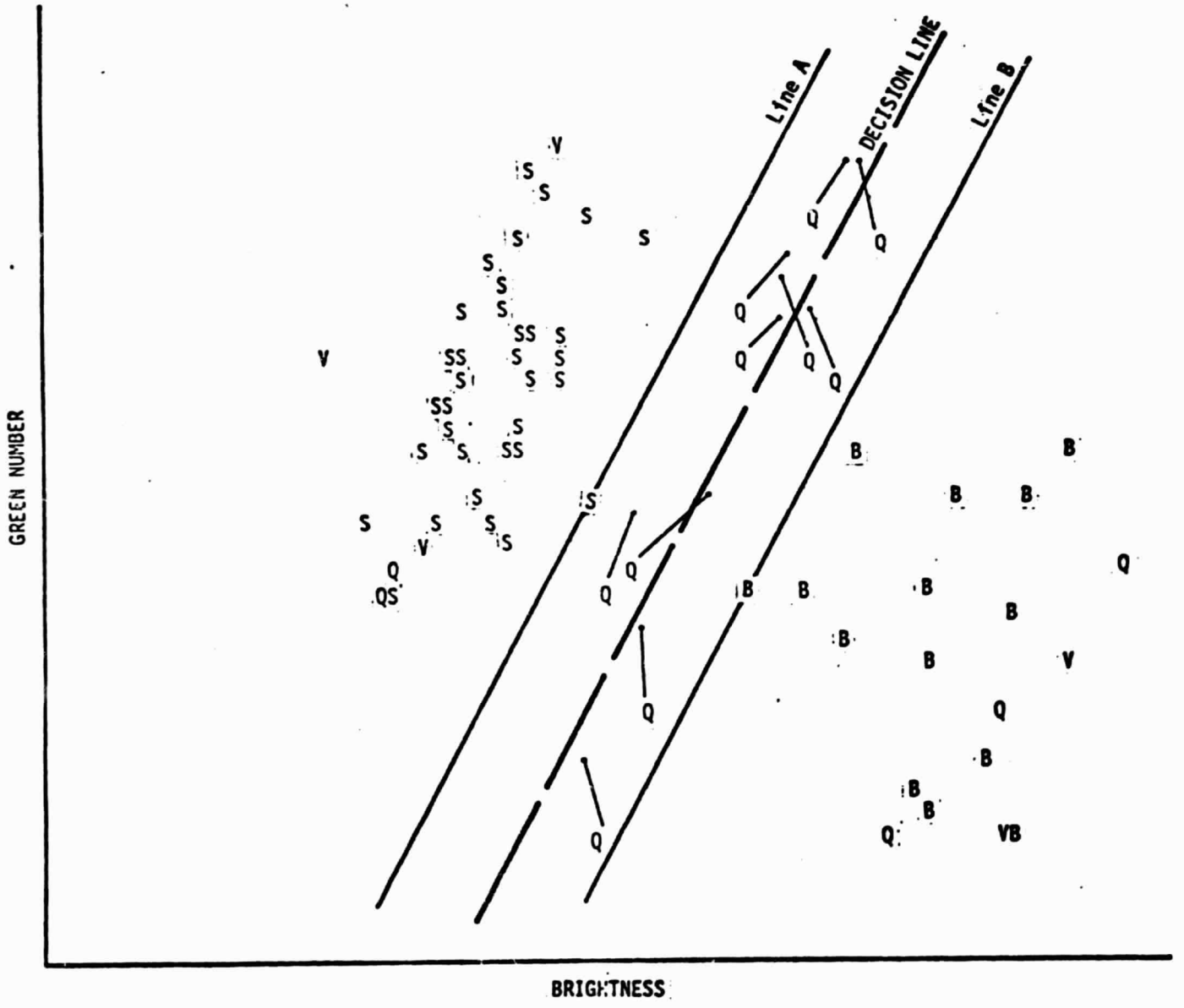
(REFORMATTED PROCEDURE)



#1

SEPARATION OF BARLEY AND OTHER SPRING SMALL GRAINS

(REFORMATTED PROCEDURE)



#1

ACQUISITION SELECTION FOR REFORMATTED PROCEDURE

STEP 1 - SELECT ACQUISITION

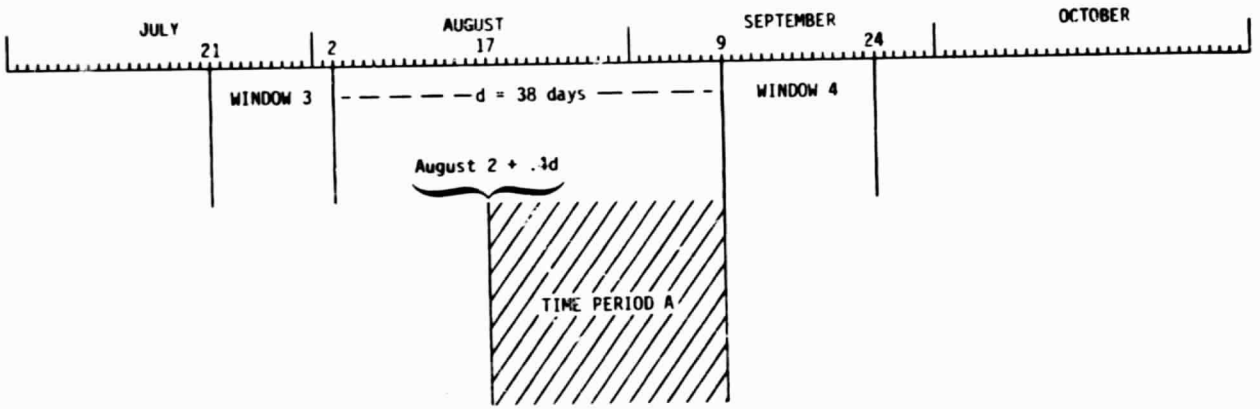
USING CROP CALENDARS FOR SPRING WHEAT AND SPRING BARLEY, DETERMINE THE OPENING AND CLOSING DATES FOR EACH OF THE FOLLOWING FOUR WINDOWS.

WINDOW	OPEN	CLOSE
1	SPRING WHEAT, 50 PERCENT PLANTED MINUS 5 DAYS	SPRING WHEAT, 50 PERCENT PLANTED PLUS 18 DAYS
2	SPRING WHEAT, 50 PERCENT HEADED MINUS 10 DAYS	SPRING WHEAT, 50 PERCENT HEADED PLUS 10 DAYS
3	SPRING BARLEY, 50 PERCENT TURNING TO RIPE MINUS 6 DAYS	SPRING BARLEY, 50 PERCENT TURNING TO RIPE PLUS 6 DAYS
4	SPRING WHEAT, 50 PERCENT HARVESTED PLUS 15 DAYS	SPRING WHEAT, 50 PERCENT HARVESTED PLUS 30 DAYS

#1

GRAPHICAL DESCRIPTION OF THE DETERMINATION OF TIME PERIOD A.

(REFORMATTED PROCEDURE)

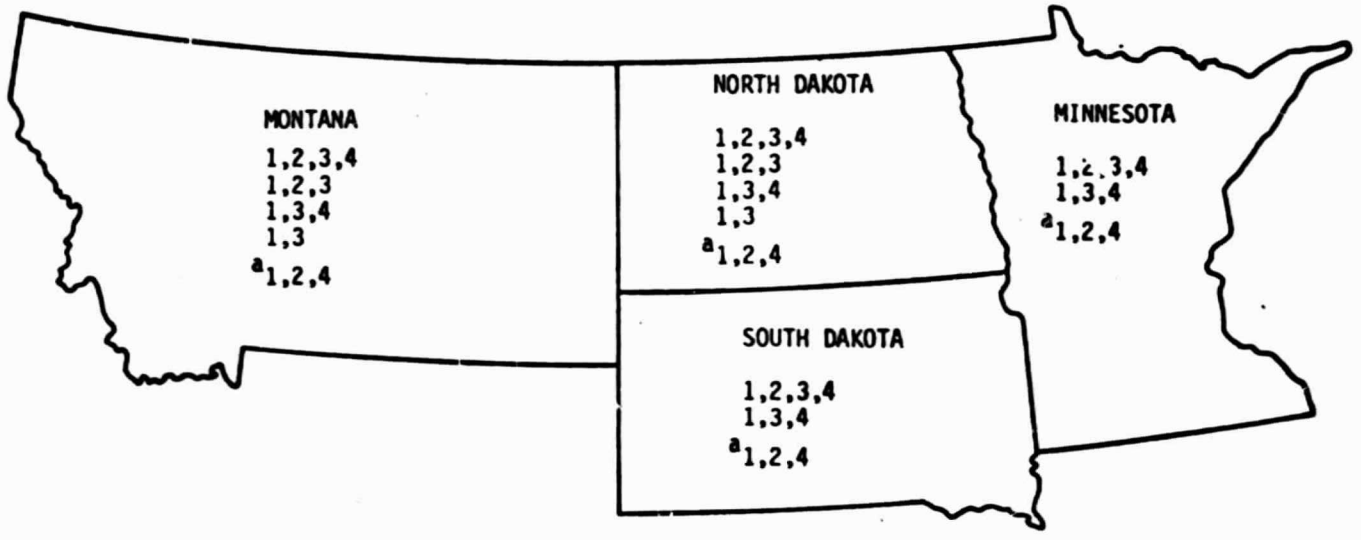


TIME PERIOD A BEGINS WITH A DATE CALCULATED AS FOLLOWS: THE DATE OF THE CLOSE OF WINDOW 3 PLUS 40 PERCENT OF THE NUMBER OF DAYS BETWEEN THE CLOSE OF WINDOW 3 AND THE OPENING OF WINDOW 4. FOR EXAMPLE: WINDOW 3 CLOSES ON AUGUST 2, AND WINDOW 4 OPENS ON SEPTEMBER 9. THERE ARE 38 DAYS BETWEEN THESE TWO DATES, AND 40 PERCENT OF 38 EQUALS 15 DAYS. AUGUST 2 PLUS 15 DAYS EQUALS AUGUST 17 WHICH IS THE START OF TIME PERIOD A IN THIS CASE. TIME PERIOD A ENDS WITH THE OPENING OF WINDOW 4.

1

PROCESSABLE DATA SETS

(REFORMATTED PROCEDURE)



[a]Inadequate for barley separation, spring small grains labeling only

#1

LABELING EXPERIMENT/DESIGN

OBJECTIVES:

GENERAL OBJECTIVE: TO TEST AND EVALUATE CANDIDATE LABELING PROCEDURES FOR SMALL GRAINS, WHEAT AND BARLEY FOR POSSIBLE APPLICATION IN USSR, AUSTRALIA AND ARGENTINA

SPECIFIC:

- EVALUATE TWO SPRING WHEAT AND BARLEY LABELING PROCEDURES (REFORMATTED AND INTEGRATED)
- SECOND YEAR EVALUATION OF INTEGRATED LABELING PROCEDURE PROPORTION ESTIMATES FOR SSG, WHEAT AND BARLEY
- COMPLETE AA OF TY RESULTS FOR U.S./CANADA TESTS

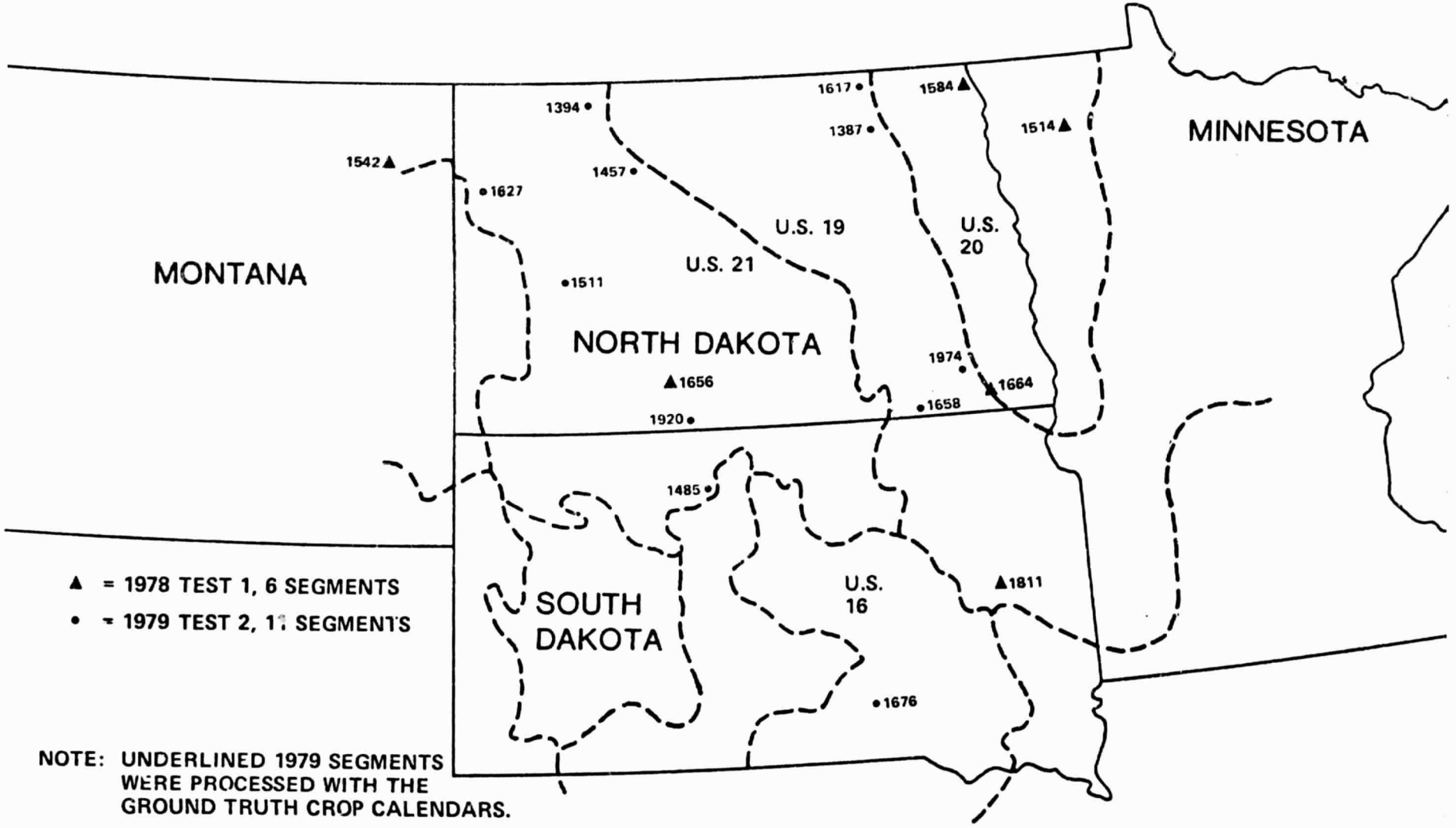
#1

EXPERIMENT DESIGN AND SCOPE -- TWO PARTS

- TEST 1 (SHAKEDOWN TEST)
  - APPLY REFORMATTED PROCEDURE TO SMALL NUMBER OF 1978 CY SEGMENTS [6 SEGMENTS/2 PROCESSING EACH (2 TEAMS)]
- TEST 2
  - APPLY REFORMATTED PROCEDURE TO 1979 CY SEGMENTS THAT SATISFY PROCEDURE REQUIREMENTS (9 SEGMENTS/2 PROCESSINGS EACH)
  - APPLY INTEGRATED PROCEDURE TO 1979 CY SEGMENTS (35 SEGMENTS - 1 PROCESSING EACH)

#1

U.S. WHEAT/BARLEY
EXPLORATORY EXPERIMENT SEGMENT LOCATIONS



NOTE: UNDERLINED 1979 SEGMENTS WERE PROCESSED WITH THE GROUND TRUTH CROP CALENDARS.

#1

REFORMATTED PROCEDURE SHAKEDOWN TEST RESULTS (6 SEGMENTS, 1978 DATA)

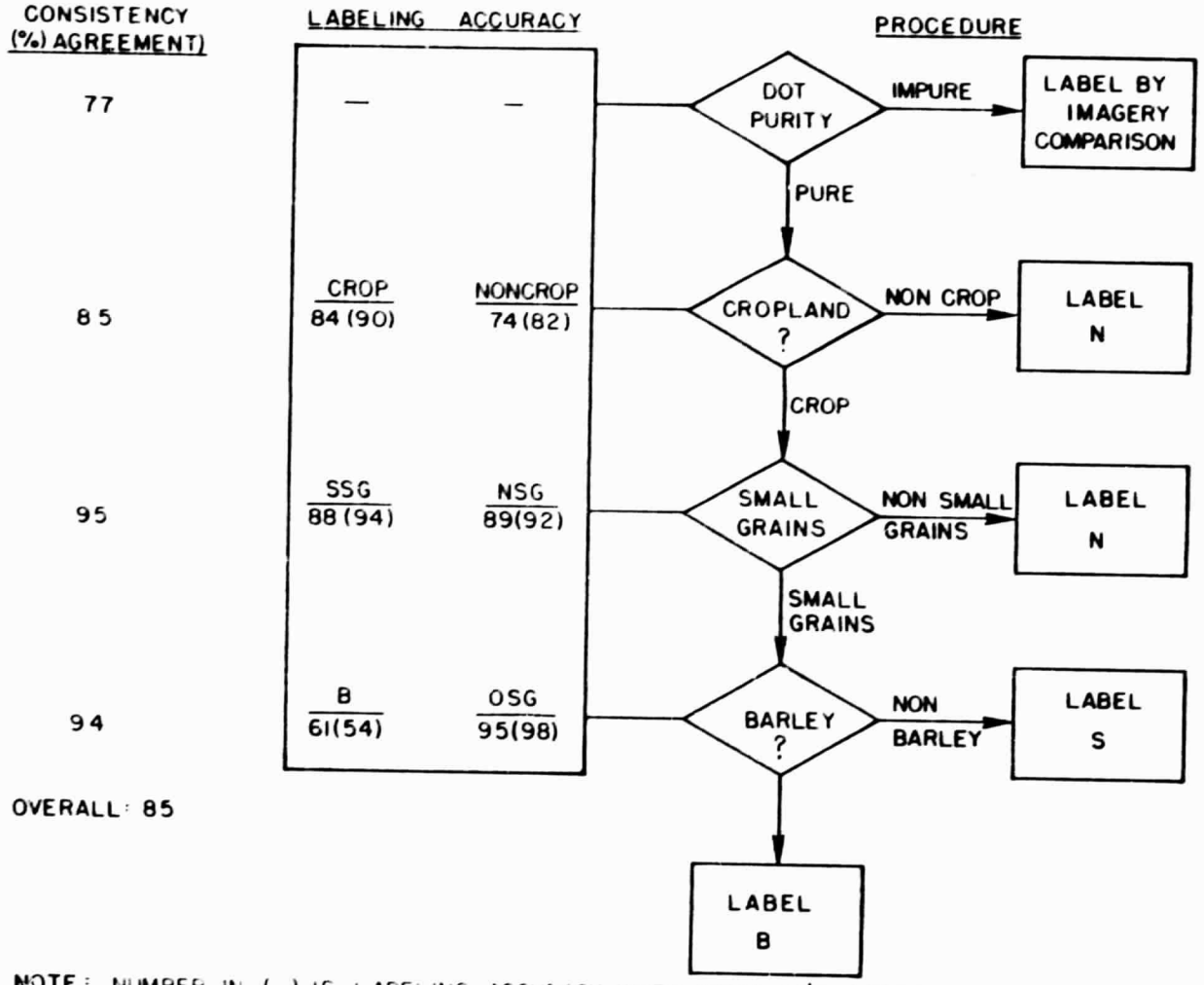
ANALYST LABELING ACCURACY (PERCENT CORRECTLY LABELED)

CROP CATEGORY	REFORMATTED PROCEDURE		INTEGRATED PROCEDURE
	ALL DOTS	PURE DOTS	
NON-SMALL GRAINS	91 (95)	94 (97)	95
TOTAL SMALL GRAINS	77 (86)	79 (87)	80
SMALL GRAINS (EXCEPT BARLEY)	72 (82)	74 (84)	75
BARLEY	51 (49)	50 (51)	57

NOTE: NUMBER IN ( ) IS LABELING ACCURACY WHEN BOTH ANALYSTS AGREED ON LABEL

#1

REFORMATTED PROCEDURE SHAKEDOWN TEST RESULTS



NOTE: NUMBER IN ( ) IS LABELING ACCURACY WHEN BOTH AI'S AGREED ON LABEL

#1

REFORMATTED PROCEDURE TEST 2 RESULTS (9 SEGMENTS, 1979 DATA)

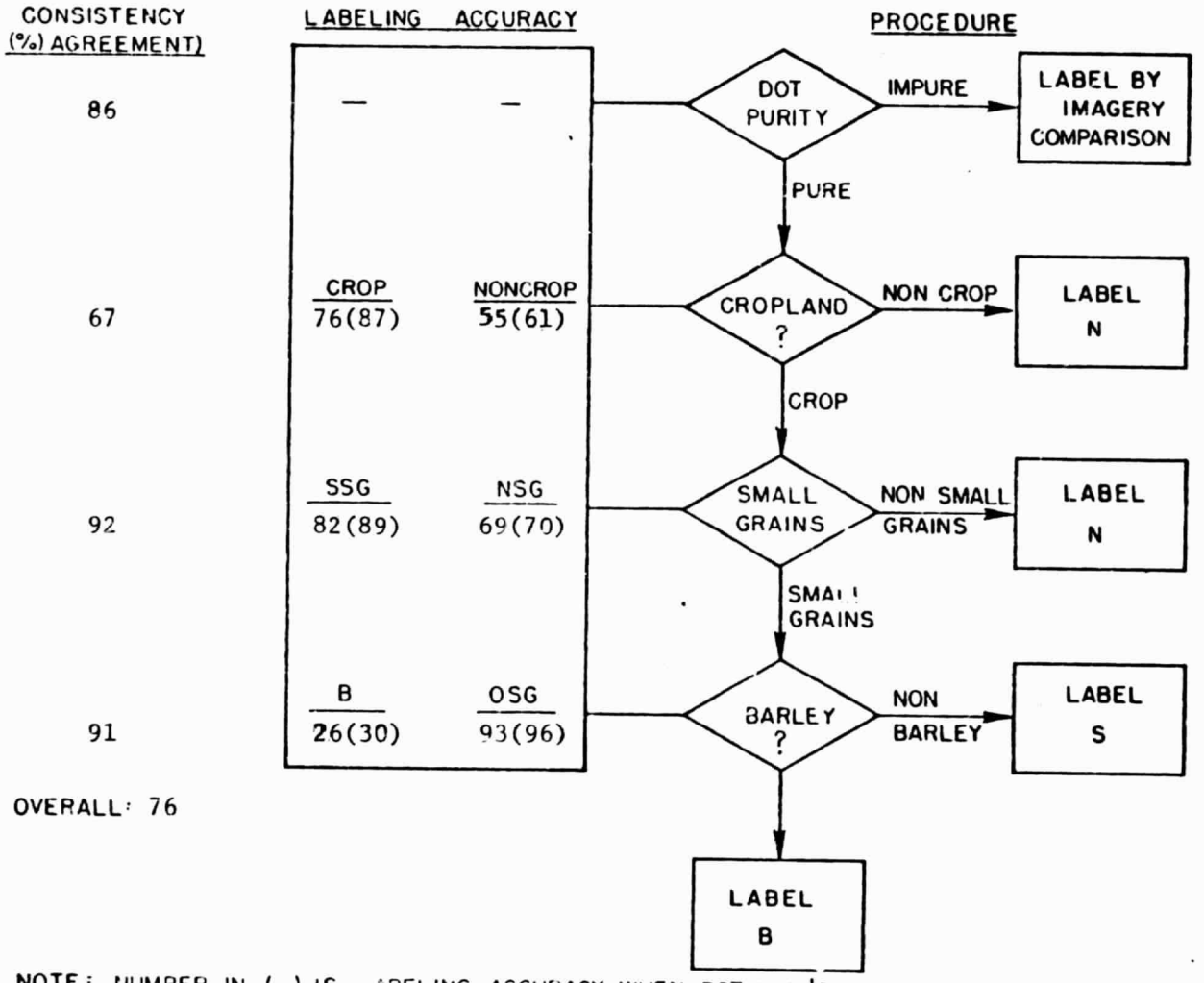
ANALYST LABELING ACCURACY (PERCENT CORRECTLY LABELED)

CROP CATEGORY	REFORMATTED PROCEDURE		INTEGRATED PROCEDURE	
	ALL DOTS	PURE DOTS	SMALL SEGMENTS AS REF. (9 SEG.)	ALL SEGMENTS AVAILABLE (35 SEG.)
NON-SMALL GRAINS	75 (81)	76 (81)	94	94
TOTAL SMALL GRAINS	66 (77)	65 (76)	76	73
SMALL GRAINS (EXCEPT BARLEY	61 (73)	61 (73)	69	66
BARLEY	15 (20)	16 (21)	59	41

NOTE: NUMBER IN ( ) IS LABELING ACCURACY WHEN BOTH ANALYSTS AGREE ON LABEL

#1

REFORMATTED PROCEDURE TEST 2 RESULTS



NOTE: NUMBER IN ( ) IS LABELING ACCURACY WHEN BOTH AI'S AGREED ON LABEL

#1

LABELING ERRORS AS A FUNCTION OF THE CROP TYPE (9 SEGMENTS - ALL LABELS)

GROUND TRUTH	BARLEY	NON-SPRING SMALL GRAINS	SPRING SMALL OTHER GRAINS	TOTAL
NON-AGRICULTURE	2	141	11	154
WATER	0	31	5	36
GRASSES	0	8	9	17
HAY	2	155	27	144
PASTURE	17	801	234	1052
ALFALFA	0	155	24	179
CLOVER	0	8	0	8
IDLE/FALLOW	69	298	95	462
WINTER WHEAT	2	3	1	6
RYE	0	4	2	6
SUGAR CANE	0	2	0	2
CORN	0	50	16	66

#1

LABELING ERRORS AS A FUNCTION OF THE CROP TYPE (9 SEGMENTS - ALL LABELS) (CONTINUED)

GROUND TRUTH	BARLEY	NON-SPRING SMALL GRAINS	SPRING SMALL OTHER GRAINS	TOTAL
MILLET	0	4	0	4
SORGHUM	0	14	1	15
SUNFLOWER	6	150	49	205
FLAX	0	13	11	24
BARLEY	9	19	26	54
OATS	9	34	37	80
DURUM WHEAT	7	115	139	261
SPRING WHEAT/SUNFLOWER	0	0	2	2
SPRING WHEAT	21	120	308	449

#1

LABELING ERROR CHARACTERIZATIONS (9 SEGMENTS)

RELATIVE IMPORTANCE OF ERROR CAUSES (ALL DOTS)

30% PASTURE (COMMISSION TO SSG)

25% MIXED, MISREGISTERED (BOTH OMISSION AND COMMISSION)

10% SUMMER CROP (COMMISSION TO SSG) (SUNFLOWERS)

10% CROP CALENDAR (OMISSION OF SSG)

5-10% IDLE/FALLOW (COMMISSION TO SSG)

15-20% PROCEDURE VARIABILITY AND CLERICAL

#1

INTEGRATED PROCEDURE LABELING ERRORS

	BARLEY	SPRING WHEAT	NON-SSG
SPRING WHEAT	50	651	267
DURUM	38	284	59
FLAX	0	22	34
BARLEY	97	86	51
OATS	6	104	95
WINTER RYE	1	3	17
WINTER WHEAT	3	7	8
CORN	0	19	267
MILLET	0	2	18
SORGHUM	0	0	10
SUNFLOWERS	3	24	519
SOYBEANS	0	4	66

INTEGRATED PROCEDURE LABELING ERRORS (CONTINUED)

	BARLEY	SPRING WHEAT	NON-SSG
DRY BEAN	0	0	15
SUGAR BEET	0	1	40
SUGAR CANE	0	0	1
ALFALFA	2	30	298
CLOVER	0	5	22
GRASSER	0	8	44
PASTURE	3	48	1353
HAY	1	19	238
IDLE/FALLOW	10	66	638
TREES	1	8	205
WATER	0	0	122
MIX CROP	0	1	7
NON-AG	2	24	420

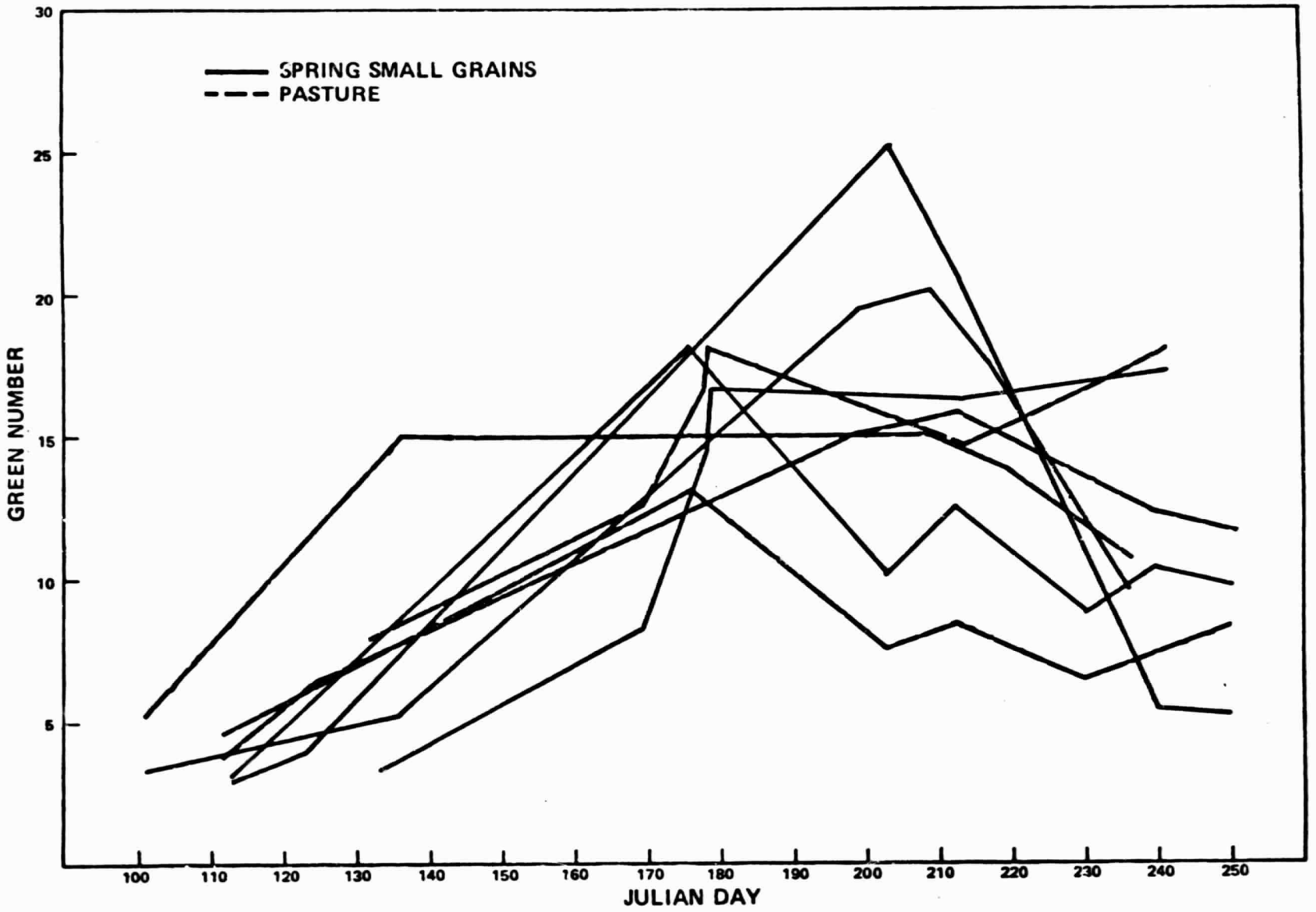
#1

U.S. WHEAT/BARLEY EXPLORATORY EXPERIMENT - TEST 2

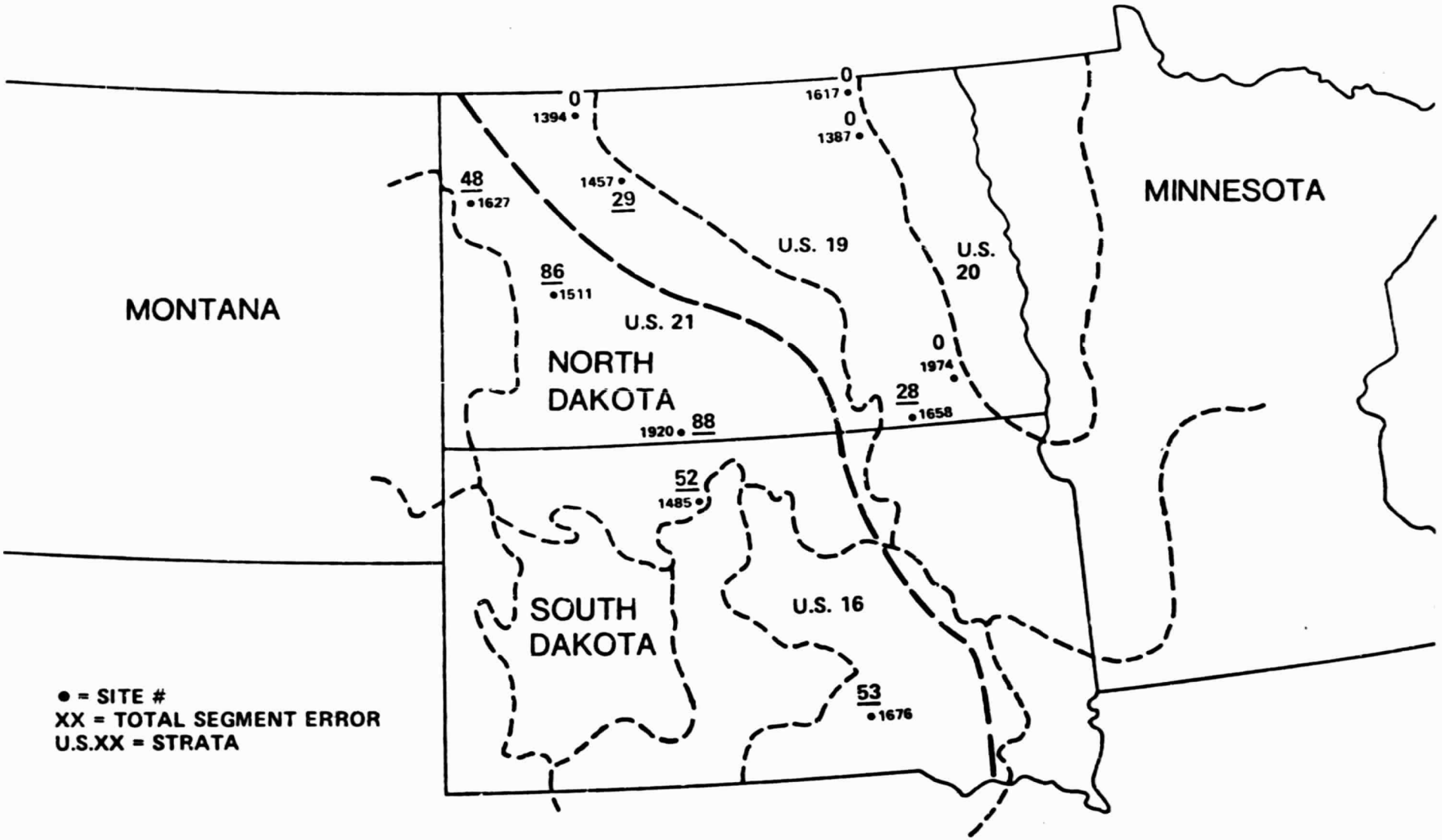
INTEGRATED PROCEDURE LABELING ERROR CHARACTERIZATION

25%	BORDER/EDGE	- OMISSION AND COMMISSION
25%	LATE DEVELOPMENT OF SPRING SMALL GRAINS (SSG)	- OMISSION
15%	NON-SSG FOLLOW SSG TEMPORAL TRAJECTORY	- COMMISSION
10%	SIGNATURE CONFUSION ON A SINGLE DATE	- OMISSION
10%	SSG FOLLOW NON-SSG TEMPORAL TRAJECTORY	- OMISSION
5%	EARLY DEVELOPMENT OF SSG	- OMISSION
10%	MISCELLANEOUS	

PASTURE AND SPRING SMALL GRAINS TRAJECTORIES



PASTURE ERRORS (TOTAL)



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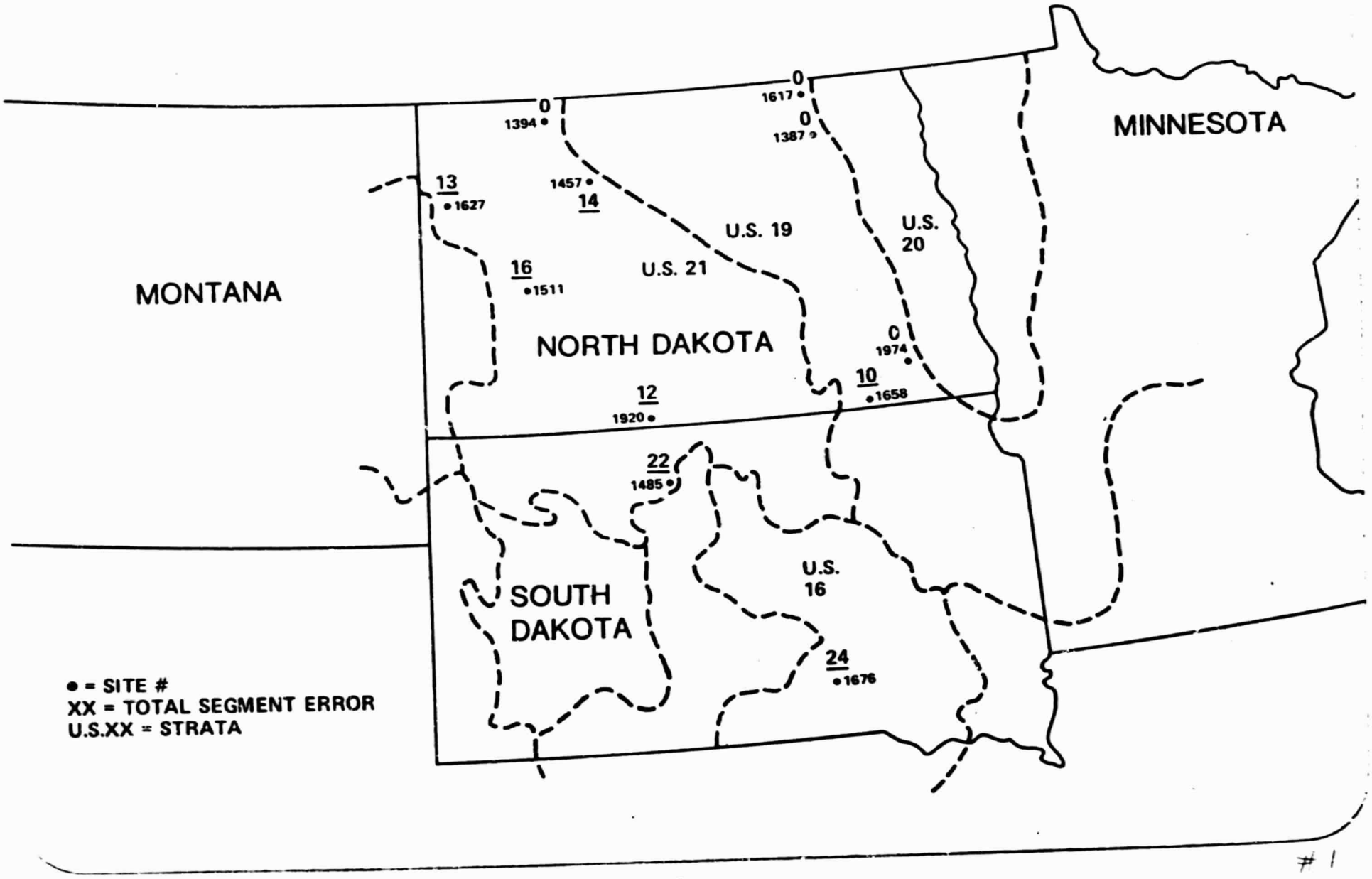
PASTURE ERRORS (BEST ANALYSIS)



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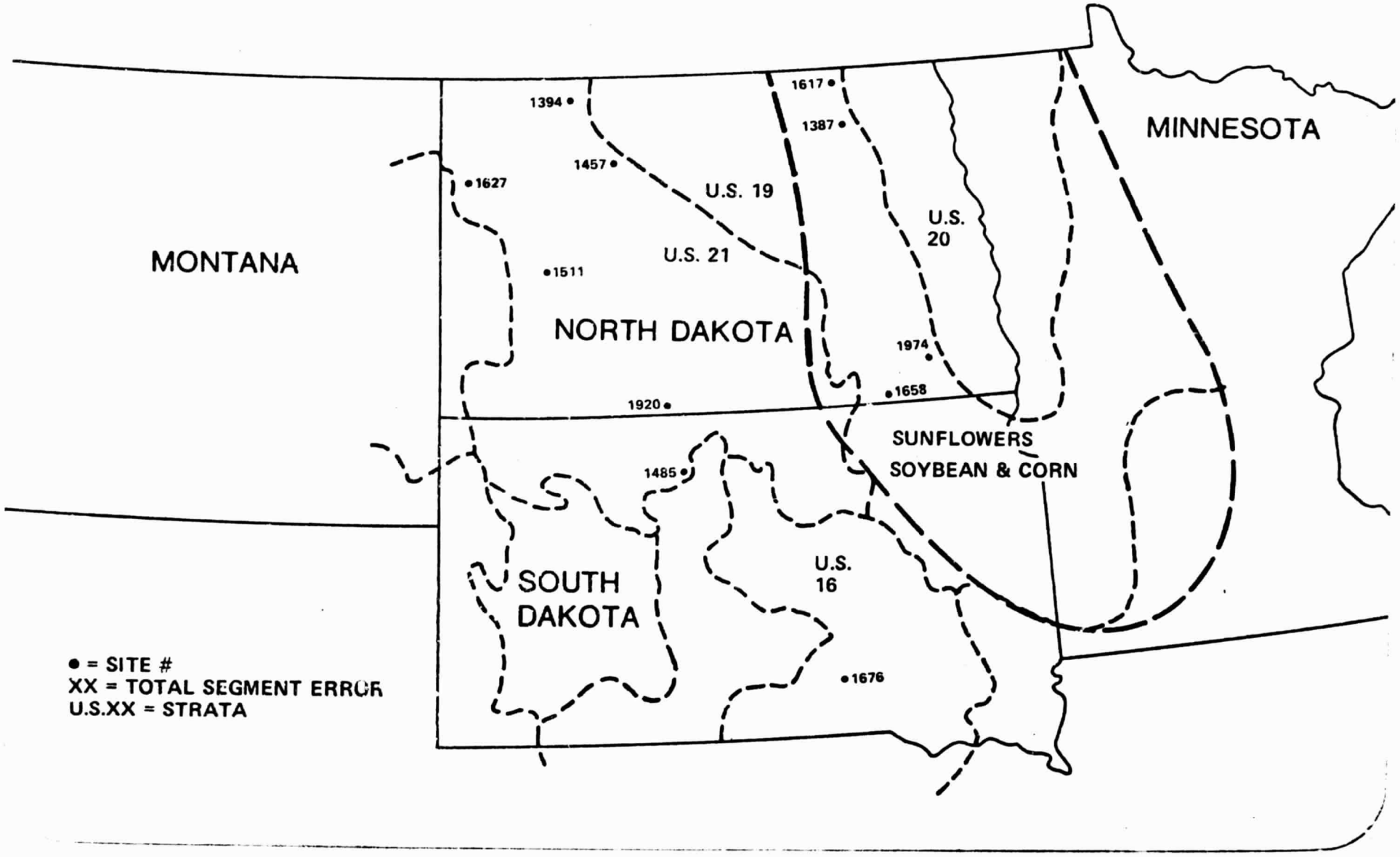
SUMMER CROP
(SUNFLOWERS AND SOYBEAN CONFUSION)



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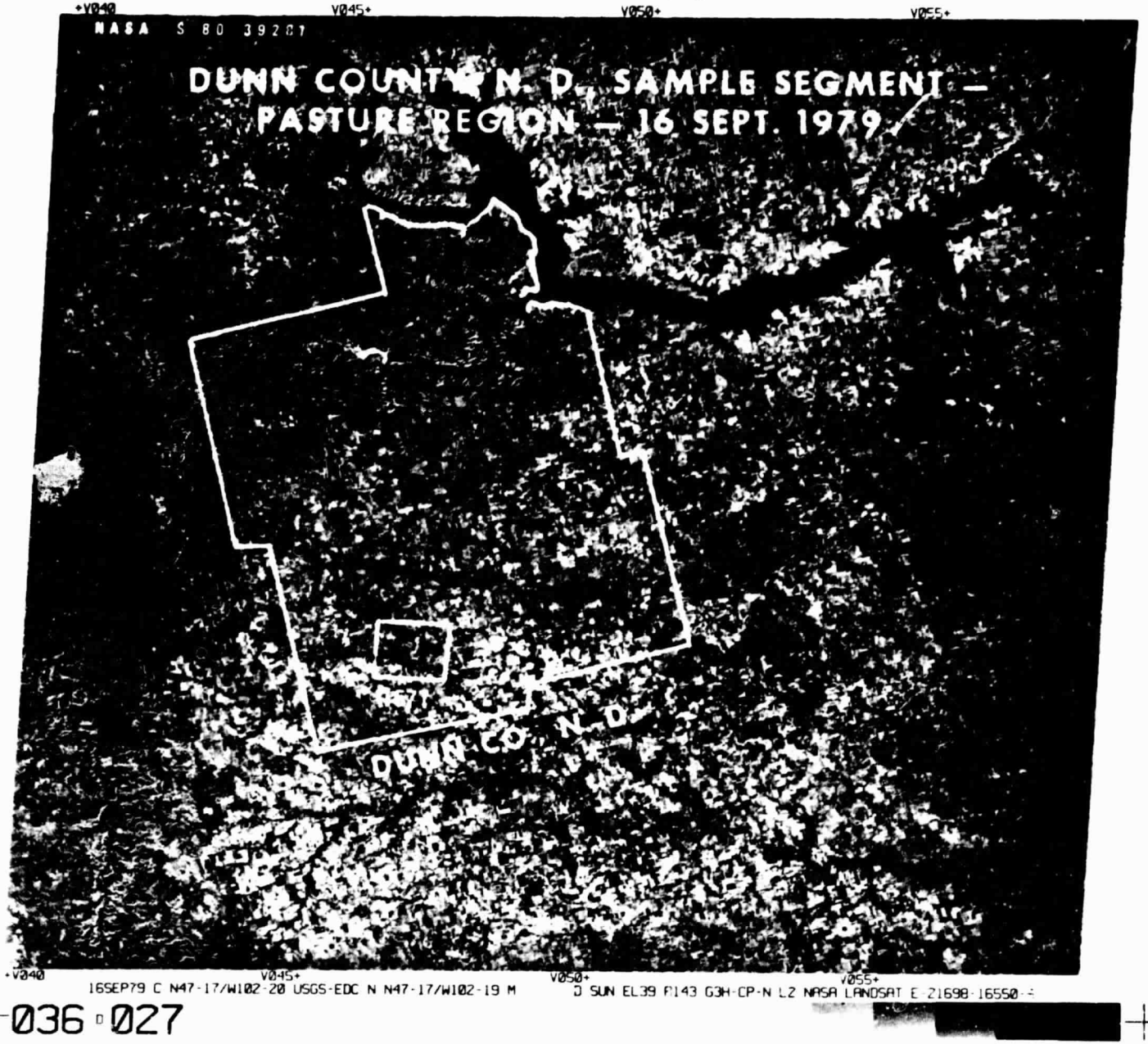

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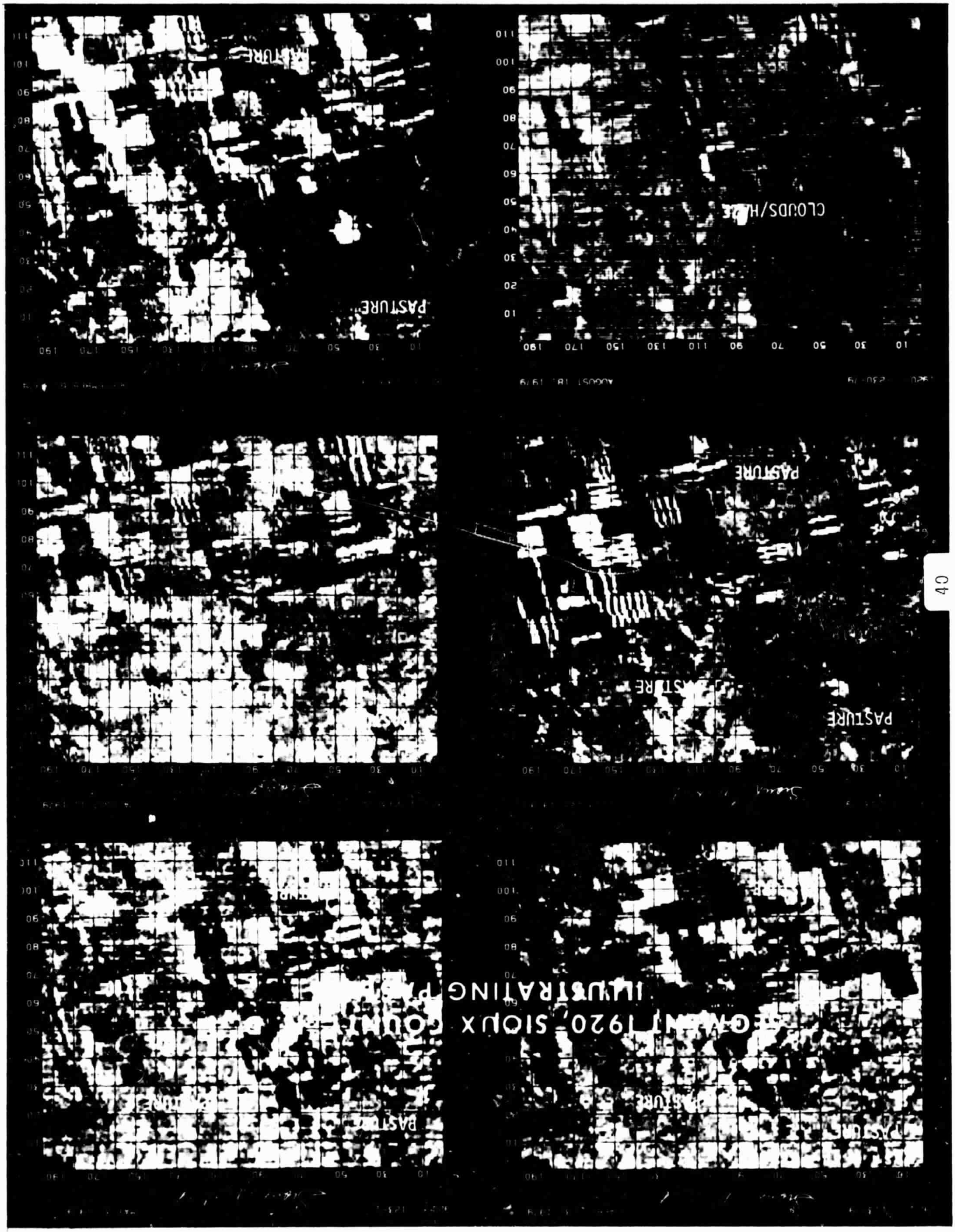

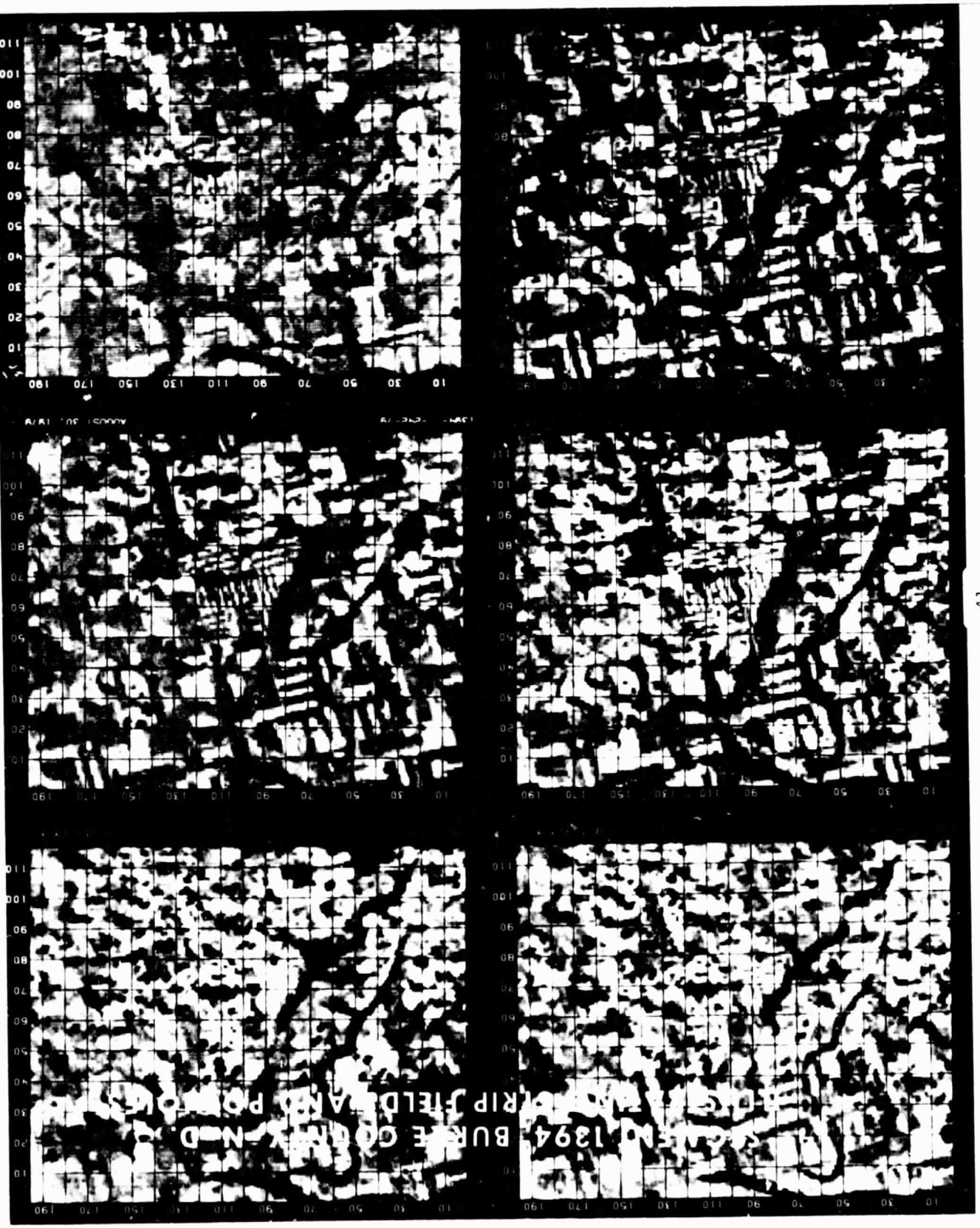

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NASA National Aeronautics and Space Administration

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Houston Texas 77058

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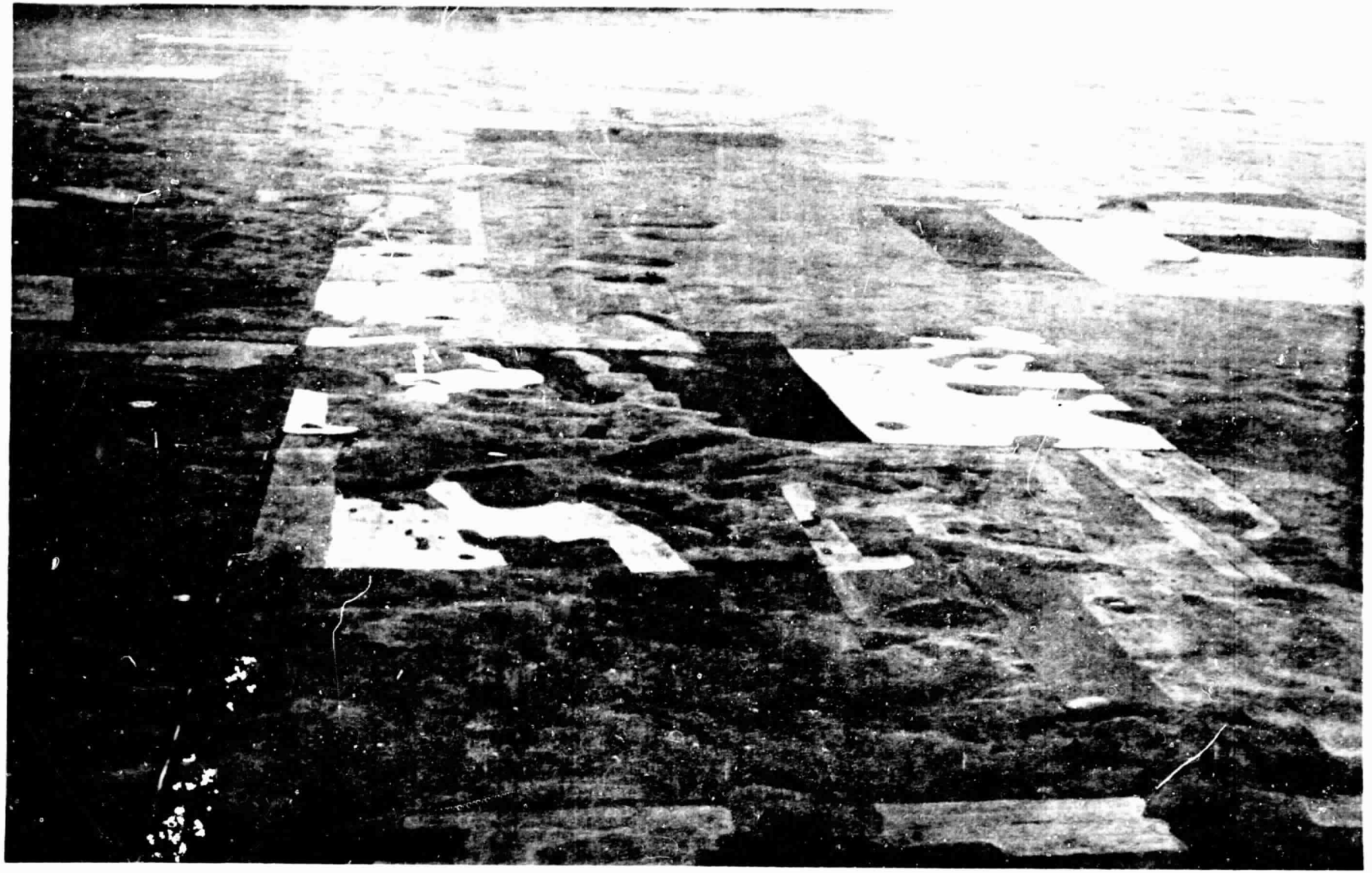

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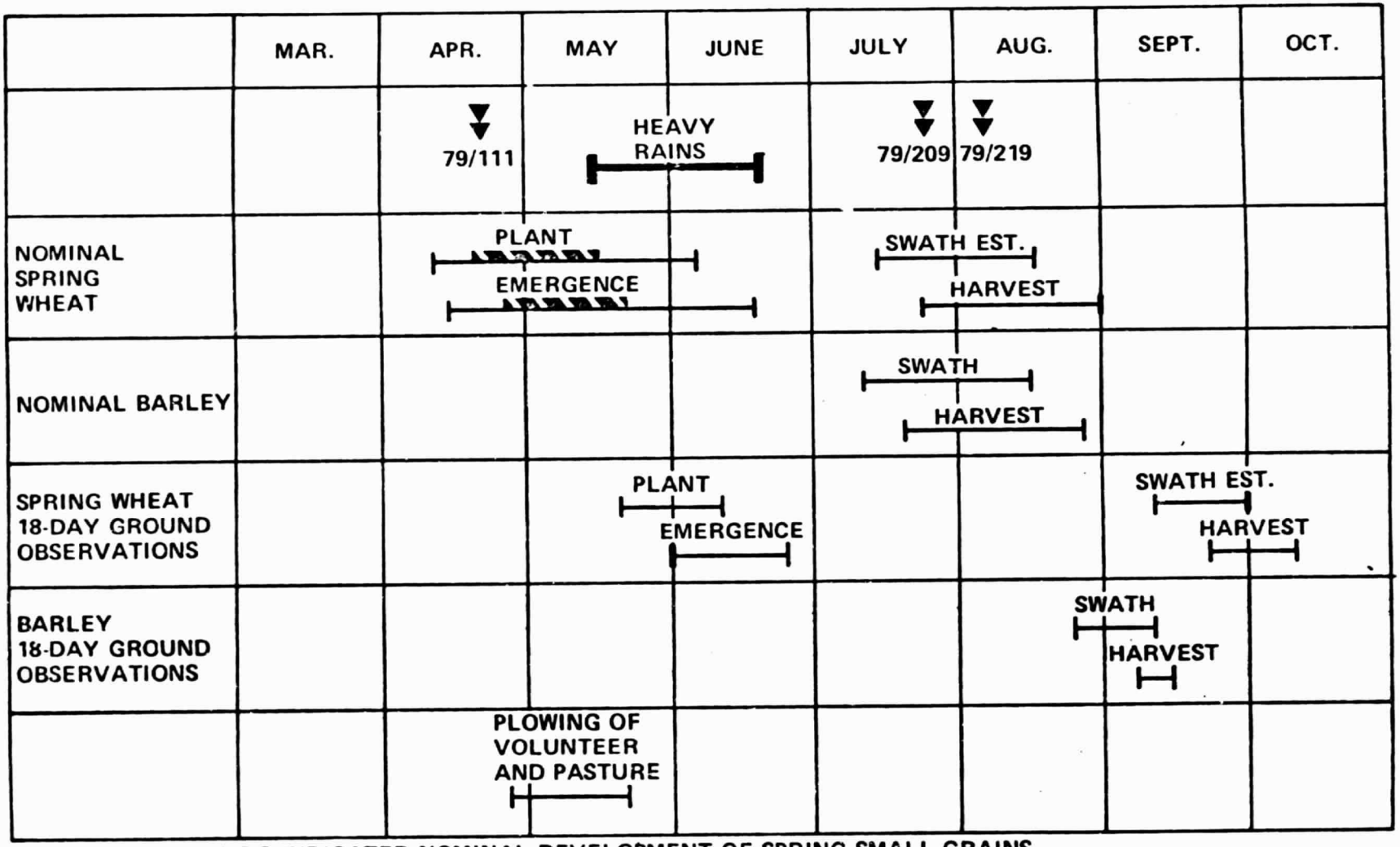
INTEGRATED PROCEDURE - CROP CALENDAR ANALYSIS

SEGMENTS 1514 AND 1518



*WEATHER ANALYSIS INDICATED NOMINAL DEVELOPMENT OF SPRING SMALL GRAINS

#1

INTEGRATED PROCEDURE CONFIDENCE ESTIMATES RESULTS
U.S. WHEAT/BARLEY EXPLORATORY TEST 2 EXPERIMENT

CONFIDENCE LEVEL	LABELING ACCURACY		NUMBER OF SEGMENTS
	S:S	N:N	
1 (HIGH)	81.8%	94.8%	7
2 (MEDIUM)	76.2%	93.4%	21
3 (LOW)	47.8%	93.1%	6
4 (VERY LOW)	69.8%	90.7%	1
CONFIDENCE LEVELS 1 AND 2 COMBINED	77.6	93.7	28

#1

INTEGRATED PROCEDURE CONFIDENCE ESTIMATES RESULTS
U.S. WHEAT/BARLEY EXPLORATORY TEST 2 EXPERIMENT

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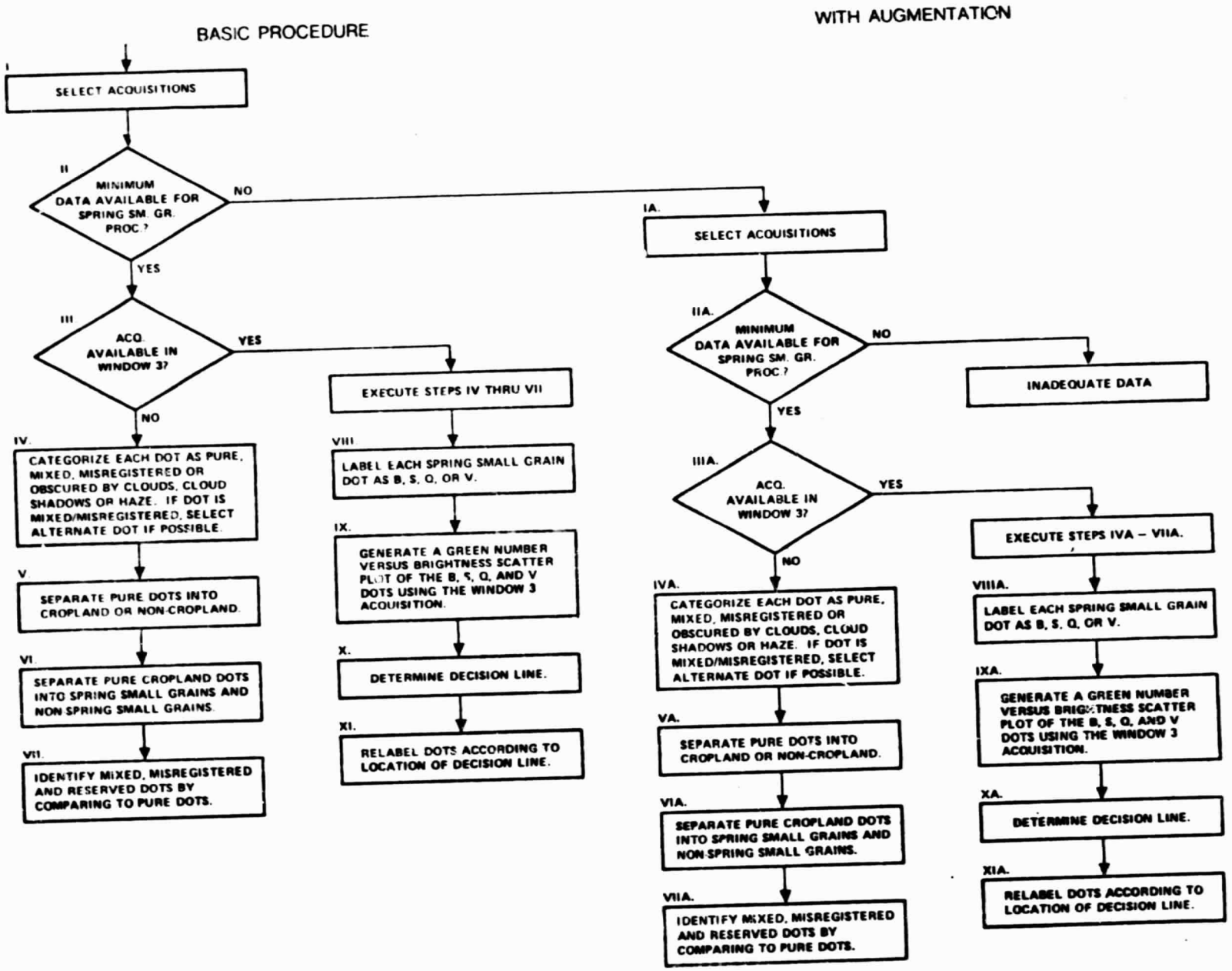
CONFIDENCE LEVELS 1 AND 2 COMBINED	77.6	93.7	28

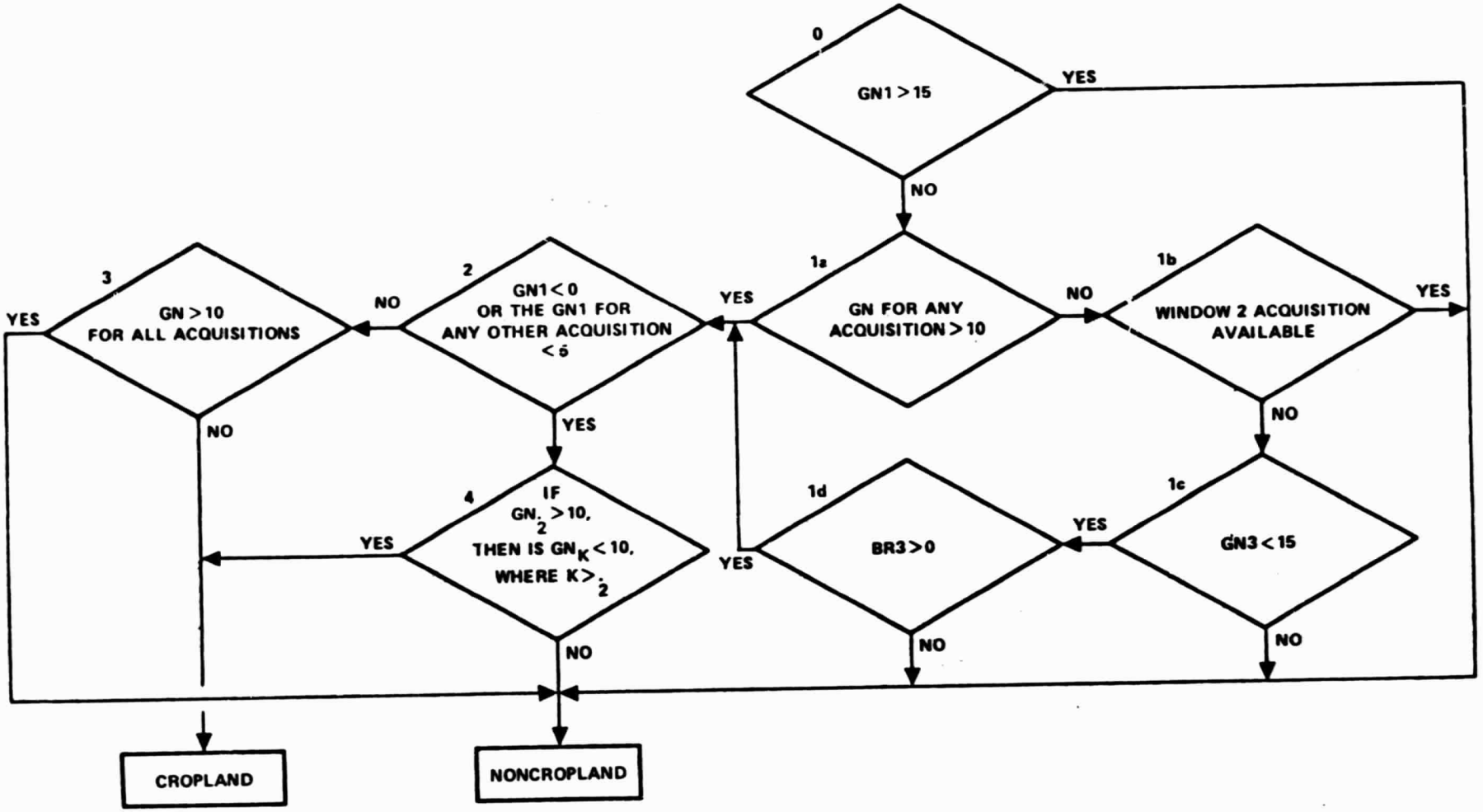
#1

REFORMATTED SPRING SMALL GRAINS LABELING PROCEDURE



#1

AUTOMATIC DECISION LOGIC FOR CROPLAND VS. NONCROPLAND



#1

AUTOMATIC DECISION LOGIC FOR CROPLAND VS NON-CROPLAND RESULTS EXAMPLE

WHEAT/BARLEY PEFORMATTED PROCEDURES FIGURE 7 LOGIC

LOGIC QUESTIONS A,B,C,D,E,F ARE YES NO ANSWERS. 1-YES 0=NO.

OBS	TYPE	DOT	GN1	BR1	GN2	BR2	GN3	BR3	A	B	C	D	E	F	L
1	PURE	1	7	45	26	57	15	53	1	.	.	0	0	.	1
2	PURE	2	5	53	43	90	48	88	1	.	.	0	0	.	1
3	PURE	5	4	54	47	90	38	82	1	.	.	0	0	.	1
4	PURE	13	37	77	41	71	11	58	1	.	.	0	0	.	0
5	PURE	10	1	45	30	60	11	66	1	.	.	0	0	.	1
6	PURE	21	3	44	34	64	18	56	1	.	.	0	0	.	1
7	PURE	32	5	48	34	64	30	60	1	.	.	0	0	.	1
8	PURE	44	2	55	40	80	50	90	1	.	.	0	0	.	1
9	PURE	55	3	56	20	63	40	81	1	.	.	0	0	.	1
10	PURE	63	1	43	36	63	22	65	1	.	.	0	0	.	1
11	PURE	76	1	60	4	46	5	55	0	1	.	.	0	.	0
12	PURE	90	23	67	29	66	21	64	1	.	.	0	0	.	1
13	PURE	97	8	72	49	89	40	88	1	.	.	0	0	.	1
14	PURE	109	4	45	33	67	15	55	1	.	.	0	0	.	1
15	PURE	118	35	73	35	68	6	61	1	.	.	0	0	.	1
16	PURE	135	4	50	-2	38	-2	59	0	1	.	.	0	.	0
17	PURE	146	5	41	33	61	32	62	1	.	.	0	0	.	1
18	PURE	155	8	50	9	59	5	55	1	.	.	0	0	.	1
19	PURE	173	6	49	22	58	24	59	1	.	.	0	0	.	1
20	PURE	196	31	55	30	65	16	53	1	.	.	0	0	.	1
21	PURE	207	12	51	18	63	26	60	1	.	.	0	1	.	1
22	PURE	46	5	59	-3	37	-2	34	1	.	.	0	0	.	0
23	PURE	14	39	79	30	60	11	59	1	.	.	0	0	.	0
24	PURE	15	4	55	4	30	0	29	0	1	.	.	0	.	0
25	PURE	25	5	40	26	58	29	54	1	.	.	0	0	.	1
26	PURE	34	4	62	44	72	25	64	1	.	.	0	0	.	1
27	PURE	45	3	41	43	82	47	88	1	.	.	0	0	.	1
28	PURE	46	5	59	-3	37	-2	34	1	.	.	0	0	.	0
29	PURE	53	20	65	29	61	22	65	1	.	.	0	0	.	1
30	PURE	69	4	55	19	52	24	60	1	.	.	0	0	.	1
31	PURE	70	2	56	22	56	11	53	1	.	.	0	0	.	1
32	PURE	74	3	46	33	61	1	52	1	.	.	0	1	.	1
33	PURE	85	2	40	28	69	35	73	1	.	.	0	0	.	1
34	PURE	89	22	63	44	77	26	68	1	.	.	0	0	.	1
35	PURE	90	23	67	29	66	21	64	1	.	.	0	0	.	1
36	PURE	95	5	33	32	63	30	64	1	.	.	0	0	.	1
37	PURE	104	2	41	33	60	18	64	1	.	.	0	0	.	1
38	PURE	115	4	38	33	62	28	62	1	.	.	0	0	.	1
39	PURE	118	35	73	35	68	6	61	1	.	.	0	0	.	0
40	PURE	139	4	44	38	80	45	88	1	.	.	0	0	.	1
41	PURE	149	4	44	22	57	29	63	1	.	.	0	0	.	1
42	PURE	168	5	40	35	65	23	53	1	.	.	0	0	.	1
43	PURE	175	4	51	13	57	17	63	1	.	.	0	0	.	1
44	PURE	185	1	42	10	60	18	57	1	.	.	0	0	.	1
45	PURE	191	13	74	29	67	30	68	1	.	.	0	0	.	1
46	PURE	194	1	50	9	51	26	58	1	.	.	0	0	.	1
47	PURE	199	2	41	30	61	20	54	1	.	.	0	0	.	1
48	PURE	204	5	49	12	55	41	73	1	.	.	0	0	.	1
49	PURE	206	6	49	10	51	43	73	1	.	.	0	0	.	1

#1

AUTOMATED DECISION LOGIC RESULTS FOR CROPLAND/NON-CROPLAND

SEGMENTS	TOTAL DOTS	TOTAL D/C	ERRORS C/D	C/D PASTURE	C/D I/F	C/D OTHER NON-CROPS INCLUDES ALFALFA	D/C	D/C	D/C OTHER SUMMER CROPS INCLUDES HAY	PASTURE LABELLED AS CROPLAND BY AUTO-DECISION LOGIC	PASTURE CORRECTLY LABELED BY INTEGRATED PROCEDURE
1387	160	3	16	--	10	6	--	2	1	0	0
1394	143	8	16	--	8	8	1	7	---	0	0
1457	130	13	12	1	8	3	1	9	3	1	0
1485	147	4	55	48	1	6	--	3	1	48	48
1571	156	3	110	94	4	12	--	2	1	94	92
1627	144	3	102	84	14	4	--	3	--	84	79
1658	124	25	4	2	--	2	10	2	13	2	2
1676	115	19	39	22	1	16	1	3	15	22	21
1920	180	4	111	93	13	5	--	--	4	93	92

#1

DEVELOPMENT OF DECISION LOGIC TO AUGMENT THE REFORMATTED SPRING SMALL GRAINS LABELING PROCEDURE

- PRELIMINARY ACQUISITION SELECTION PROCEDURE HAS BEEN DEFINED.
- TENTATIVE MINIMUM DATA REQUIREMENTS HAVE BEEN IDENTIFIED.
- BASIC DESIGN OF DECISION LOGIC HAS BEEN DEVELOPED.
- ACCEPTABLE RESULTS HAVE BEEN ACHIEVED BY APPLYING DECISION RULES TO COMBINATIONS OF ACQUISITIONS UNPROCESSABLE BY THE STANDARD PROCEDURE.
- PRELIMINARY INDICATIONS ARE THAT APPROXIMATELY EIGHTY PERCENT OF THE CANDIDATE SEGMENTS CAN BE PROCESSED WITH REASONABLE ACCURACY.

#1

SUMMARY/RECOMMENDATIONS

- LABELING TECHNOLOGY FOR END-OF-SEASON SPRING SMALL GRAINS WILL BE VIABLE FOR THE FY81 US/CANADA PILOT
- IMPLEMENTATION OF AUTOMATIC LABELING SHOULD CONTINUE FOR INCLUSIONS INTO THE FY81 PILOT
- FURTHER RESEARCH AND DEVELOPMENT OF CROP GROWTH STAGE MODELING IS NEEDED
- ACQUISITION SELECTION TECHNIQUES BASED ON LANDSAT AND WEATHER ANALYSIS SHOULD BE INITIATED
- BASIC RESEARCH INTO THE FACTORS AFFECTING LABELING SHOULD BE ENHANCED

#1

U.S./CANADA WHEAT/BARLEY EXPLORATORY

EXPERIMENT FOR 1980

MACHINE PROCESSING--P1A

SEPTEMBER 24, 1980

ATTACHMENT #2

o GENERAL OBJECTIVES

a. EVALUATE A CANDIDATE MACHINE PROCESSING TECHNOLOGY FOR IMPROVED AREA ESTIMATION IN FOLLOW-ON FCPF PROJECT EXPLORATORY AND PILOT EXPERIMENTS.

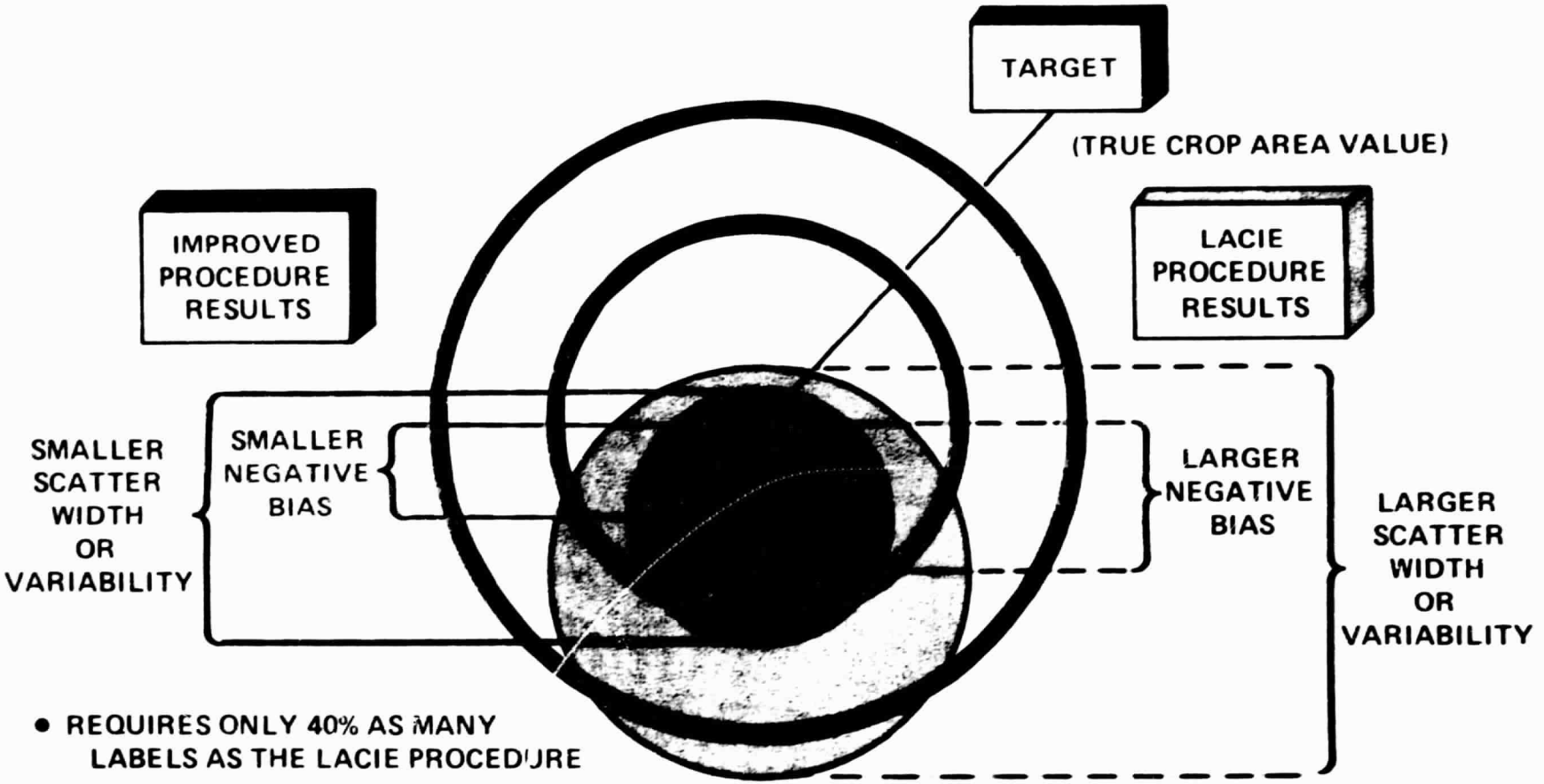
b. DEVELOP RECOMMENDATIONS FOR ADDITIONAL RESEARCH, DEVELOPMENT, AND TESTS REQUIRED TO INCORPORATE AN IMPROVED AREA ESTIMATION TECHNOLOGY INTO FOLLOW-ON FCPF PROJECT EXPLORATORY AND PILOT EXPERIMENTS.

- BACKGROUND
  - NEED MORE EFFICIENT UTILIZATION OF LABELED SAMPLES IN SEGMENT PROPORTION ESTIMATION
    - LACIE PHASE III AND TY STUDIES
    - P1 AND SIMPLE RANDOM SAMPLING EQUIVALENT
  - SUPPORTING RESEARCH DEVELOPED THE BAYES SEQUENTIAL PROPORTION ESTIMATION PROCEDURE
  - SMALL TEST ON 10 SEGMENTS CONDUCTED BY SUPPORTING RESEARCH
    - AT LEAST A TWO-TO-ONE REDUCTION IN MSE COMPARED TO P1
    - ANALYST LABELING ACCURACY IMPROVED
    - PROPORTION ESTIMATION BIAS REDUCED
  - RECOMMENDED A LARGER TEST FOR CONFIRMATION

#2

NASA-S-80-10257

EVALUATION OF AN IMPROVED SEGMENT ANALYSIS PROCEDURE



- REQUIRES ONLY 40% AS MANY LABELS AS THE LACIE PROCEDURE

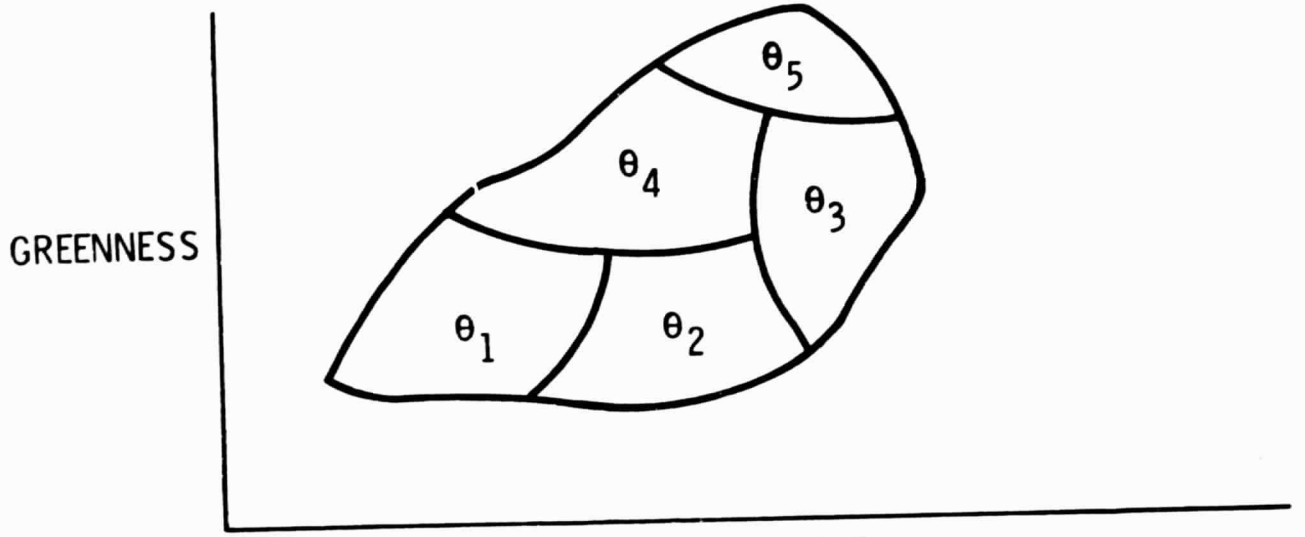
A TEST OVER 10 SMALL GRAINS SEGMENTS THROUGHOUT U.S. GREAT PLAINS

#2

	P1	BAYES SEQUENTIAL	PROPOSED ADVANTAGE
STEP 1 STRATIFICATION	o ISOCLS o USE TYPE 1 LABELED DOTS TO COLLAPSE CLUSTERS INTO TWO STRATA	o CLASSY	o NO NEED TO LABEL DOTS TO CREATE SMALL NUMBER OF STRATA FOR SAMPLING THUS MORE EFFICIENT
STEP 2 ALLOCATION OF DOTS TO BE LABELED	o APPROXIMATELY PROPORTIONAL TO SIZE OF STRATA (POST-STRATIFICATION)	o SEQUENTIAL TO MINIMIZE MEAN SQUARE ERROR	o NEED LESS DOTS FOR SAME ACCURACY BY INCORPORATION OF 1) PRIOR INFORMATION OF REDISTRIBUTION OF CLUSTER PURITY. 2) KNOWLEDGE OF PREVIOUSLY LABELED SAMPLES o MORE ACCURATE LABELING FOR SELECTED DOTS
STEP 3 STRATA LEVEL ESTIMATION	o RELATIVE COUNT	o BAYES	o REDUCTION IN MEAN SQUARE ERROR FOR EQUIVALENT NUMBER OF DOTS BY INCLUDING PRIOR INFORMATION OF DISTRIBUTION OF CLUSTER PURITY.
STEP 4 SEGMENT LEVEL ESTIMATION	o WEIGHTED AVERAGE OVER STRATA	o WEIGHTED AVERAGE OVER STRATA	NONE (SAME)

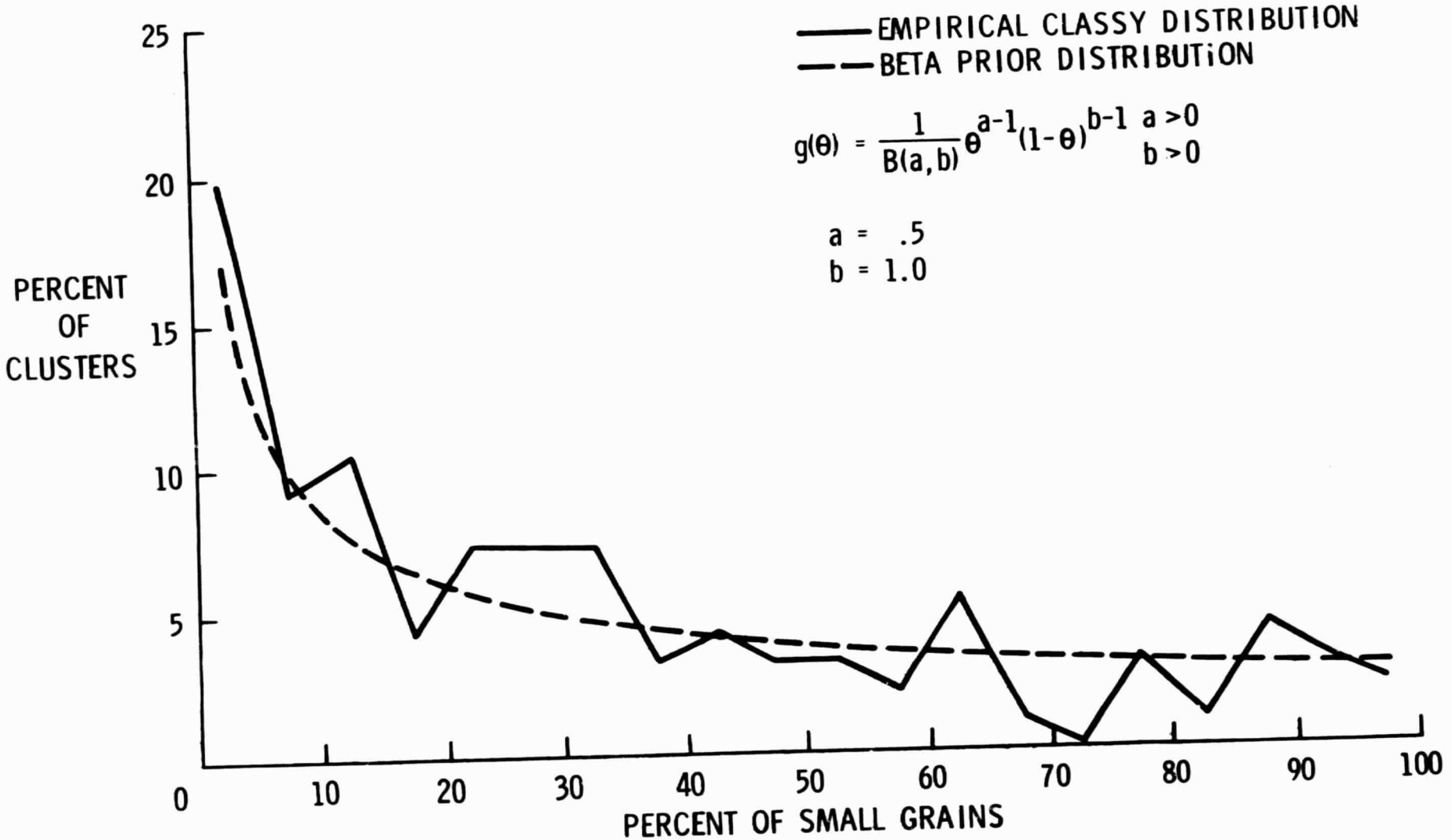
#2

SPECTRAL SPACE FOR A SINGLE ACQUISITION



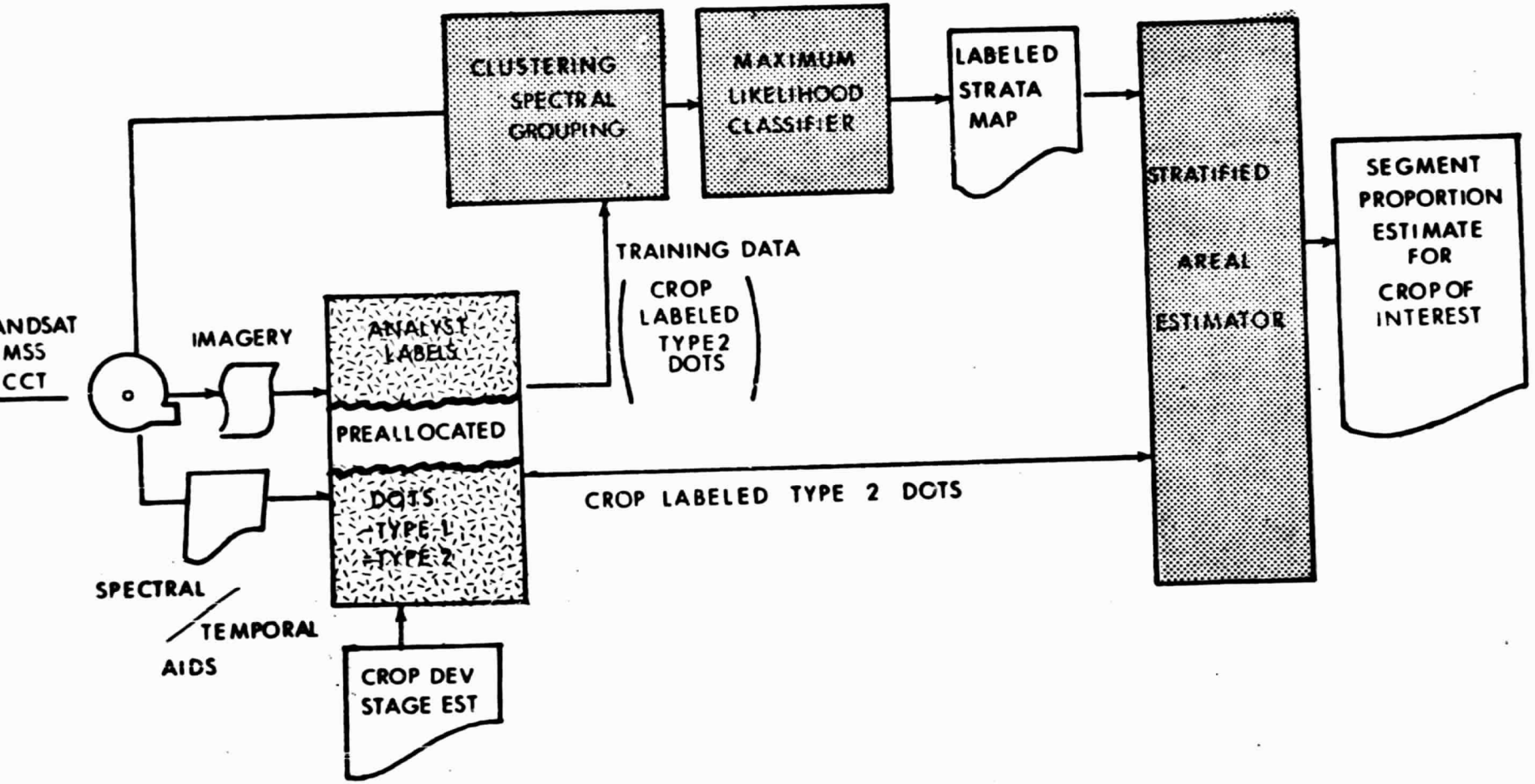
θ_K = PROPORTION OF CROP OF INTEREST IN THE K^{TH} STRATA

#2


EMPIRICAL CLASSY DISTRIBUTION
BETA PRIOR DISTRIBUTION
$g(\theta) = \frac{1}{B(a,b)}\theta^{a-1}(1-\theta)^{b-1}$ a >0 b >0
a = .5
b = 1.0
PERCENT OF CLUSTERS
25
20
15
10
5
0
10
20
30
40
50
60
70
80
90
100
PERCENT OF SMALL GRAINS

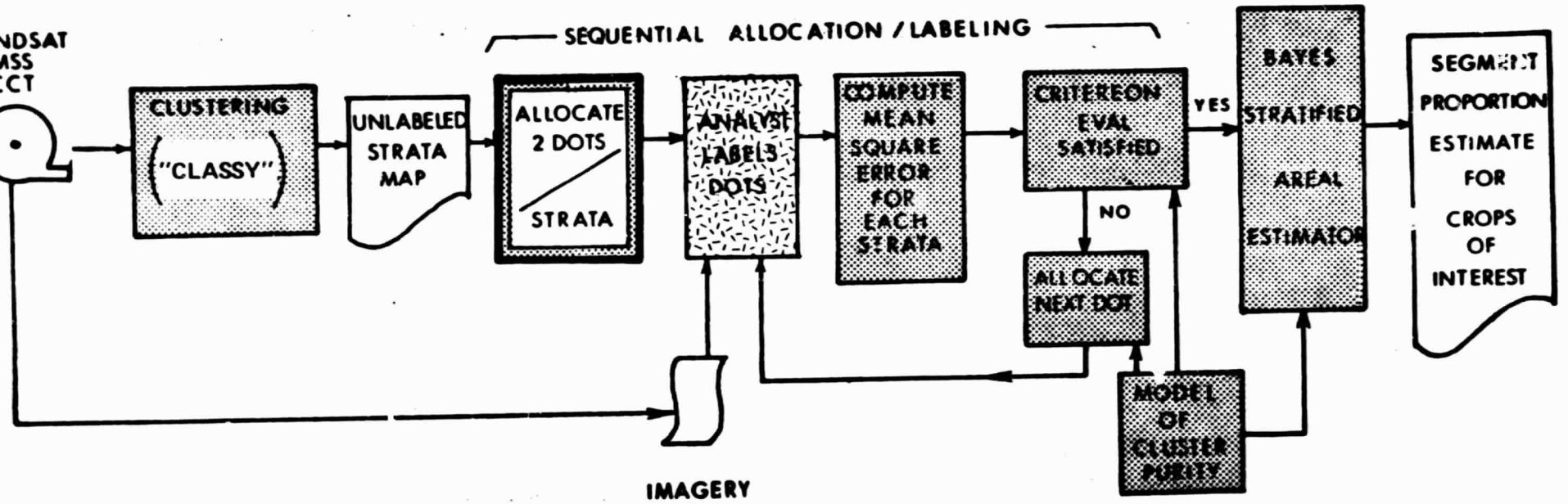
#2

SEGMENT ANALYSIS PROCEDURE 1



#2

SEGMENT ANALYSIS USING BAYES SEQUENTIAL ALLOCATION PROCEDURE



- SPECIFIC OBJECTIVES

  VERIFY THAT THE BAYES SEQUENTIAL ESTIMATION PROCEDURE WILL SIGNIFICANTLY REDUCE THE MEAN SQUARE ERROR IN PROPORTION ESTIMATION.

  VERIFY THAT THE LABELING ACCURACY IMPROVES WITH SEQUENTIAL ALLOCATION AND REDUCES THE BIAS IN PROPORTION ESTIMATION.

  ASSESS THE RELATIVE BENEFIT FROM EACH OF THE THREE CHANGES CONTAINED IN THE BAYES SEQUENTIAL ESTIMATION PROCEDURE

  - STRATIFICATION WITH CLASSY
  - BAYES ESTIMATION
  - SEQUENTIAL ALLOCATION

  RECOMMEND THE PROPORTION ESTIMATION PROCEDURE TO USE IN THE FOLLOW-ON 1981 U.S./CANADA WHEAT/BARLEY PILOT EXPERIMENT.

#2

o APPROACH

+ APPLY FOUR PROPORTION ESTIMATION PROCEDURES TO THE 35 1979 WHEAT/BARLEY BLIND SITES USED IN THE U.S./CANADA LABELING EXPERIMENT.

PROPORTIONAL ALLOCATION WITH RELATIVE COUNT

- o CLASSY STRATIFICATION

RANDOM SAMPLE

- o NO STRATIFICATION
- o RELATIVE COUNT ESTIMATOR

PROPORTIONAL ALLOCATION WITH BAYES ESTIMATOR

- o CLASSY STRATIFICATION

BAYES SEQUENTIAL ALLOCATION

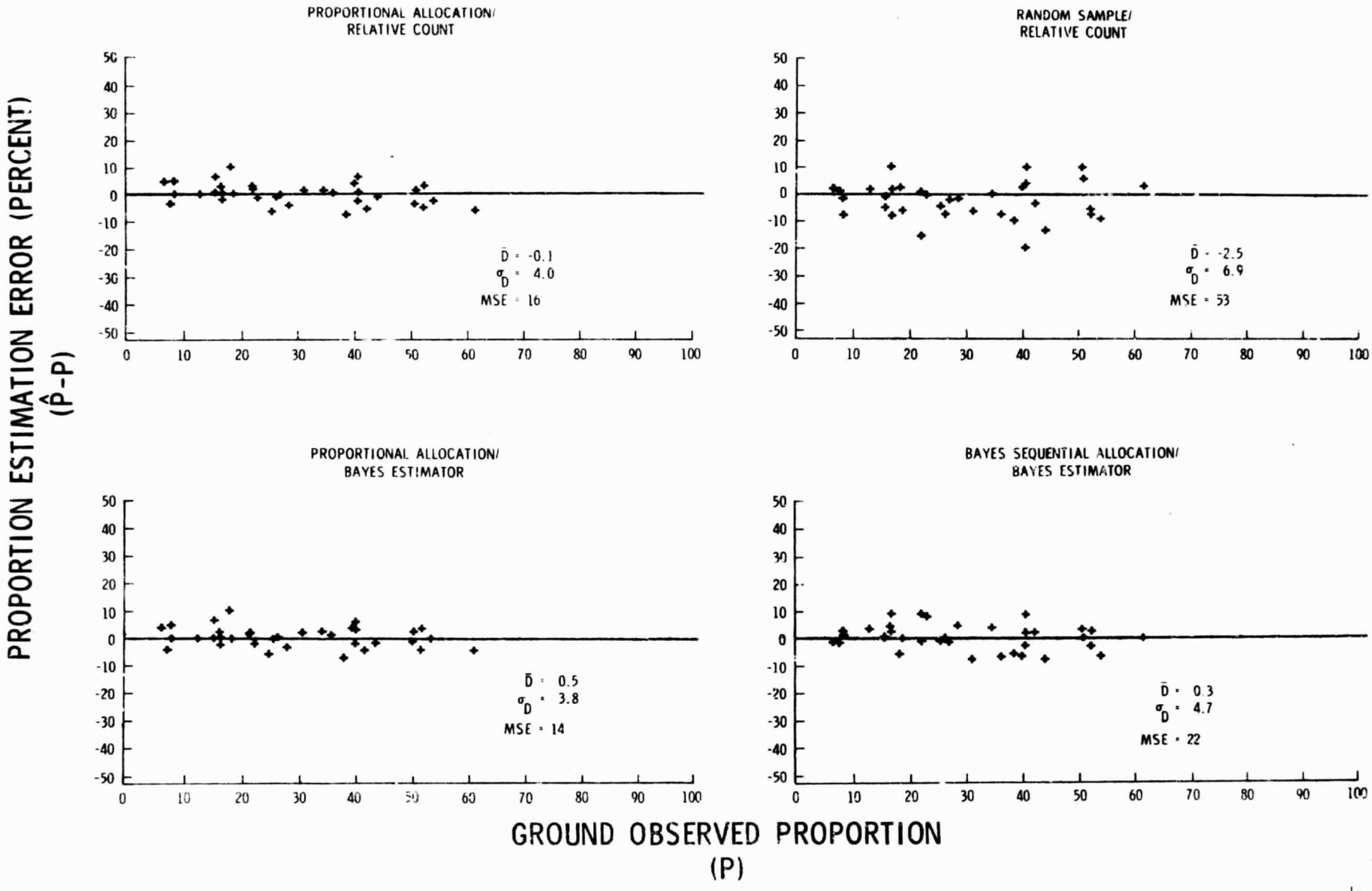
- o CLASSY STRATIFICATION
- o BAYES ESTIMATOR

+ USE BOTH A FIXED NUMBER OF DOTS (50) AND A VARIABLE NUMBER DETERMINED BY A MSE THRESHOLD

+ ACQUISITION DATES SELECTED FOR CLASSY ARE THOSE FOR THE REFORMATTED PROCEDURE. IF NOT POSSIBLE, THE DATES ARE SELECTED BY THE DETAILED ANALYSIS PROCEDURES FOR TRANSITION YEAR PROJECT (FY79).

#2

PROPORTION ESTIMATION RESULTS WITH GROUND TRUTH LABELS



SUMMARY OF RESULTS--MACHINE

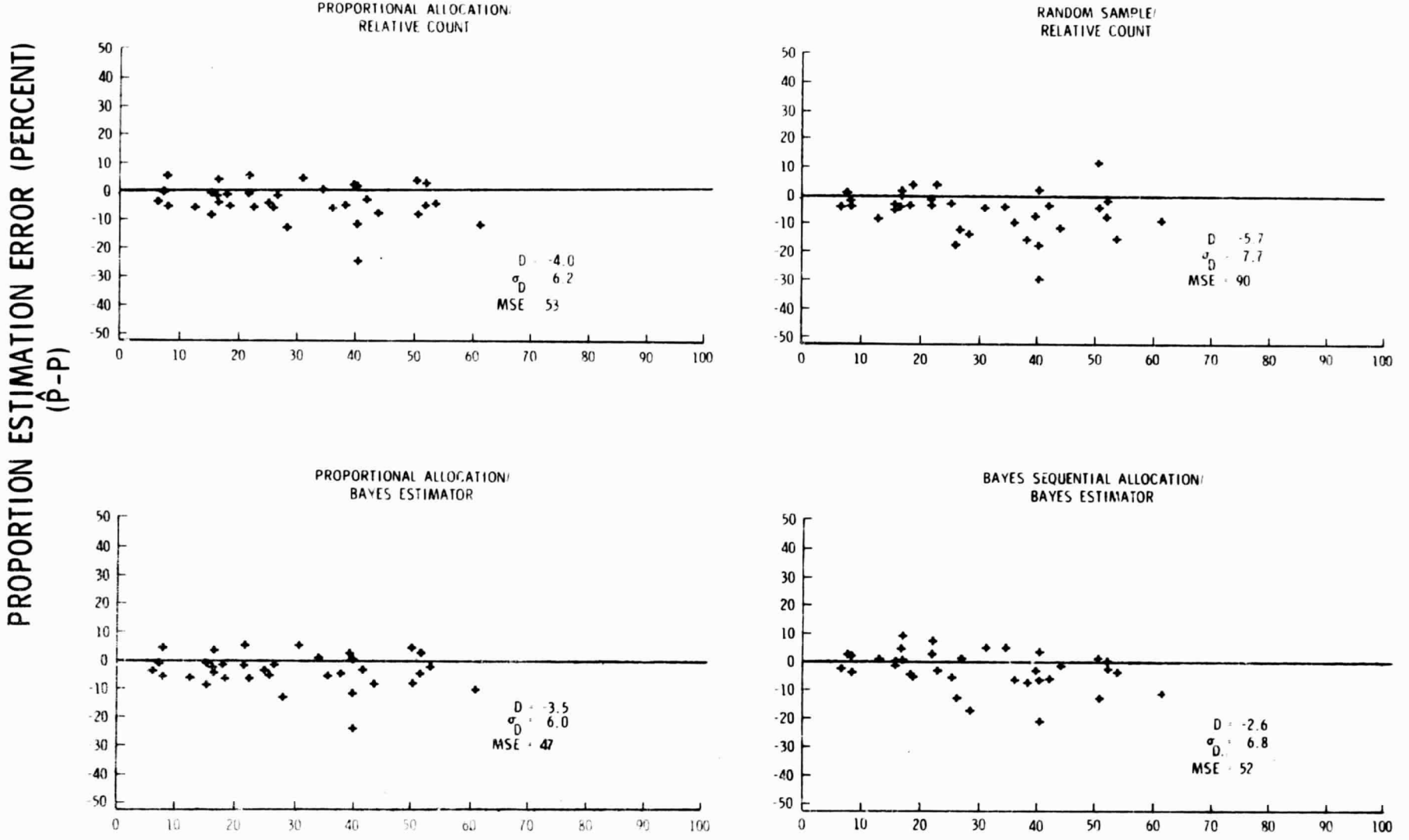
PROCESSING--P1A EXPERIMENT

- o RESULTS BASED ON GROUND TRUTH LABELS
  - + SIGNIFICANT INCREASE IN PRECISION BY CLASSY STRATIFICATION OVER RANDOM SAMPLING
    --RANDOM SAMPLING REQUIRES 3 TIMES AS MANY DOTS TO ACHIEVE SAME PRECISION AS CLASSY STRATA.
  - + NO SIGNIFICANT IMPROVEMENT DUE TO ALLOCATION SCHEME OR BAYES ESTIMATOR

- o RESULTS BASED ON ANALYST LABELS
  - + SLIGHT INCREASE (NOT STATISTICALLY SIGNIFICANT) IN PRECISION BY CLASSY STRATIFICATION OVER RANDOM SAMPLING
    --RANDOM SAMPLING REQUIRES 1.5 TIMES AS MANY DOTS TO ACHIEVE SAME PRECISION AS CLASSY STRATA
  - + BIAS IS SMALLER (AS ANTICIPATED) WITH BAYES SEQUENTIAL ALLOCATION/BAYES ESTIMATOR, THOUGH NOT STATISTICALLY SIGNIFICANT.

#2

PROPORTION ESTIMATION RESULTS WITH ANALYST LABELS



- UNFINISHED ANALYSES
  - --EVALUATE WHETHER ANALYST LABELING IS BETTER FOR SEQUENTIALLY ALLOCATED DOTS THAN FOR PROPORTIONALLY ALLOCATED DOTS.
  - --COMPARE ESTIMATORS WITH VARIABLE NUMBER OF DOTS (AS DETERMINED BY MSE THRESHOLD IN BAYES SEQUENTIAL ESTIMATION SCHEME)

o CONCLUSIONS

+ FIRST DEMONSTRATION THAT MACHINE PROCESSING PROVIDED SIGNIFICANT GAIN IN EFFICIENCY OVER RANDOM SAMPLING

+ SIGNIFICANT IMPROVEMENT IN EFFICIENCY WILL BE ACHIEVED BY SUBSTITUTING CLASSY IN P1

--NO LONGER HAVE TO LABEL TYPE I DOTS

--CLASSY STRATA SIGNIFICANTLY IMPROVED PRECISION OVER RANDOM SAMPLING

--PRIOR TESTS SHOWED P1 PRECISION EQUIVALENT TO RANDOM SAMPLING PRECISION

#2

- ISSUES

  + CLASSY BIG CONSUMER OF CPU TIME

    --15-20 MINUTES FOR 2 ACQUISITIONS

    --30-45 MINUTES FOR 4 ACQUISITIONS

  + WITH LARGE NUMBER OF LABELED DOTS, AS IN CURRENT WHEAT/BARLEY LABELING PROCEDURE (209), EXPECTED GAIN IN PRECISION OVER RANDOM SAMPLING WOULD BE SMALL.

#2

U.S./CANADA WHEAT/BARLEY - CROP CALENDAR EXPERIMENT

0 GENERAL OBJECTIVES:

+ EVALUATE STATE-OF-THE-ART PLANTING DATE AND CROP STAGE MODELS FOR SPRING WHEAT AND BARLEY FOR THEIR ABILITY TO

-- PREDICT SPRING WHEAT AND BARLEY PLANTING DATES AND CROP STAGES

-- ASSIST LABELING AND CLASSIFICATION PROCEDURES

ATTACHMENT #3

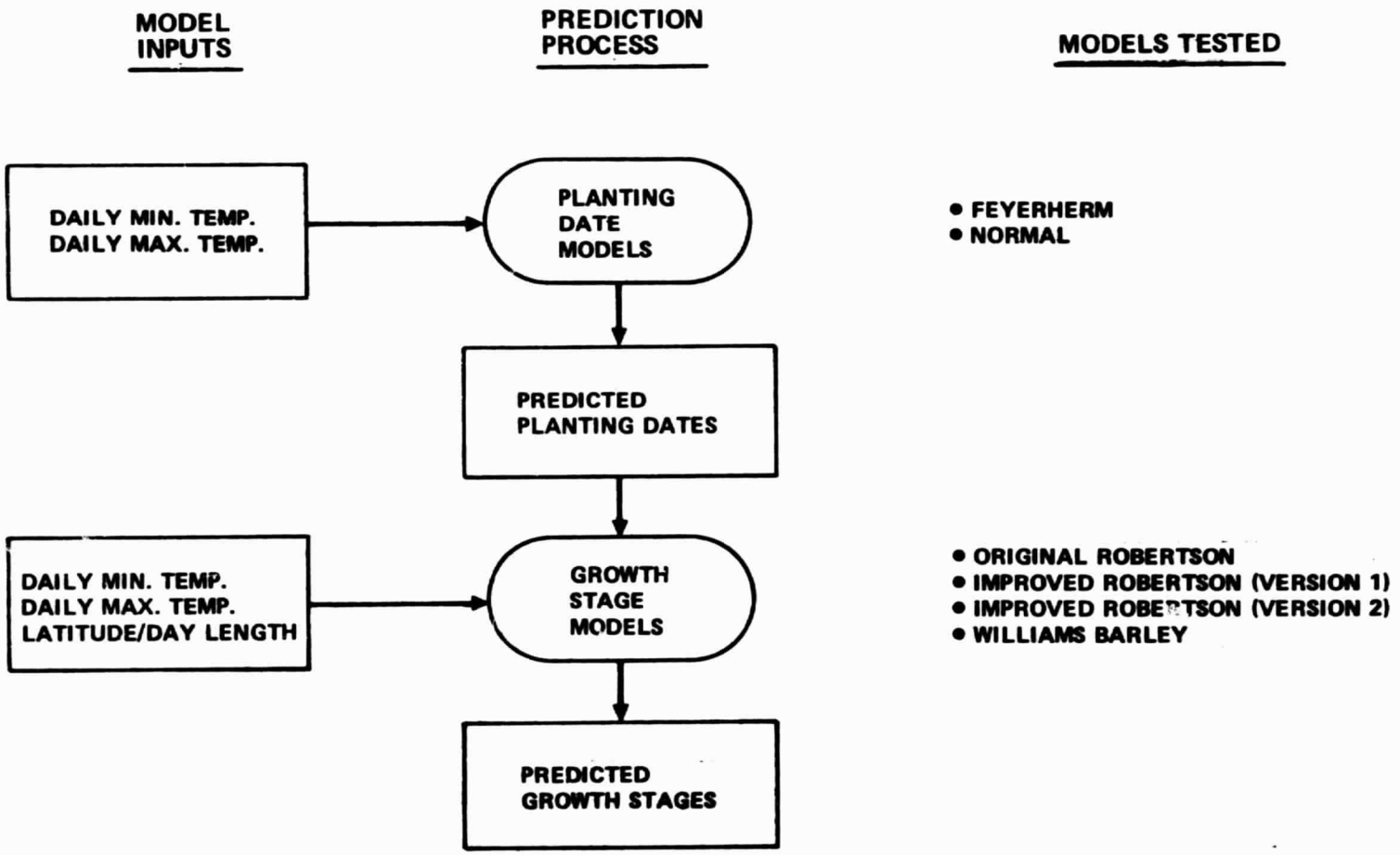
0 BACKGROUND

+ DURING LACIE, SPRING WHEAT PLANTING DATE AND CROP CALENDAR MODELS BASED ON HISTORICAL NORMALS WERE IMPROVED BY USE OF THE FEYERHERM PLANTING DATE MODEL AND THE ROBERTSON SPRING WHEAT CROP CALENDAR MODEL

+ MODIFICATIONS WERE MADE TO ROBERTSON MODEL TO IMPROVE DEFICIENCIES IDENTIFIED IN LACIE EVALUATIONS

+ SR CROP CALENDAR PROJECT ELEMENT RECOMMENDED TESTING OF THESE MODIFICATIONS AND TESTING WILLIAMS BARLEY MODEL FOR THE FIRST TIME.

#3

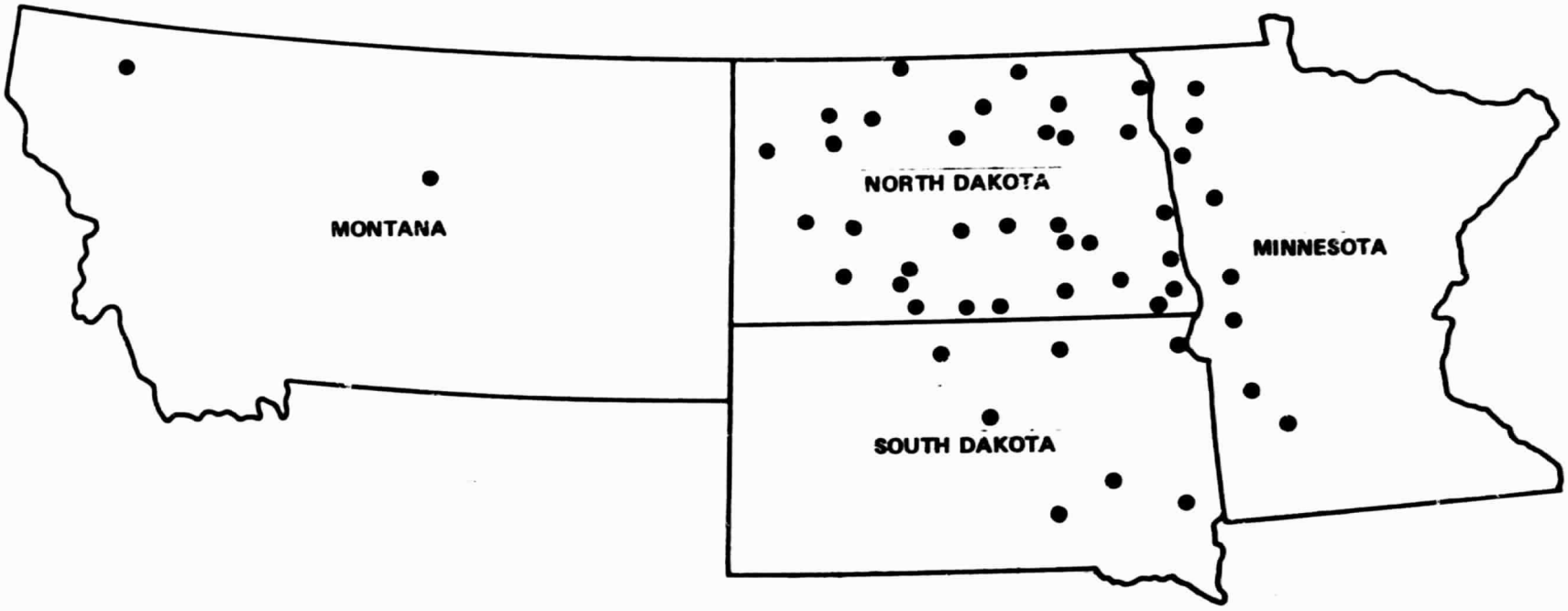

MODEL INPUTS
PREDICTION PROCESS
MODELS TESTED
DAILY MIN. TEMP.
DAILY MAX. TEMP.
PLANTING DATE MODELS
PREDICTED PLANTING DATES
DAILY MIN. TEMP.
DAILY MAX. TEMP.
LATITUDE/DAY LENGTH
GROWTH STAGE MODELS
PREDICTED GROWTH STAGES
• FEYERHERM
• NORMAL
• ORIGINAL ROBERTSON
• IMPROVED ROBERTSON (VERSION 1)
• IMPROVED ROBERTSON (VERSION 2)
• WILLIAMS BARLEY

3

- SPECIFIC OBJECTIVES
  - DETERMINE IF THE FEYERHERM PLANTING DATE MODEL MORE ACCURATELY PREDICTS THE MEDIAN PLANTING DATE AT THE SEGMENT LEVEL THAN THE NORMAL
  - DETERMINE GROWTH STAGE MODEL WHICH MOST ACCURATELY PREDICT THE MEDIAN CROP GROWTH STAGE AT THE SEGMENT LEVEL AS A FUNCTION OF TIME FOR SPRING WHEAT AND FOR BARLEY.
  - DETERMINE IF THE BARLEY MODEL MORE ACCURATELY PREDICTS THE BARLEY GROWTH STAGES THAN DO THE SPRING WHEAT MODELS.
  - DETERMINE HOW WELL MODELS IDENTIFY THE BIOWINDOWS REQUIRED BY THE REFORMATTED LABELING PROCEDURE.

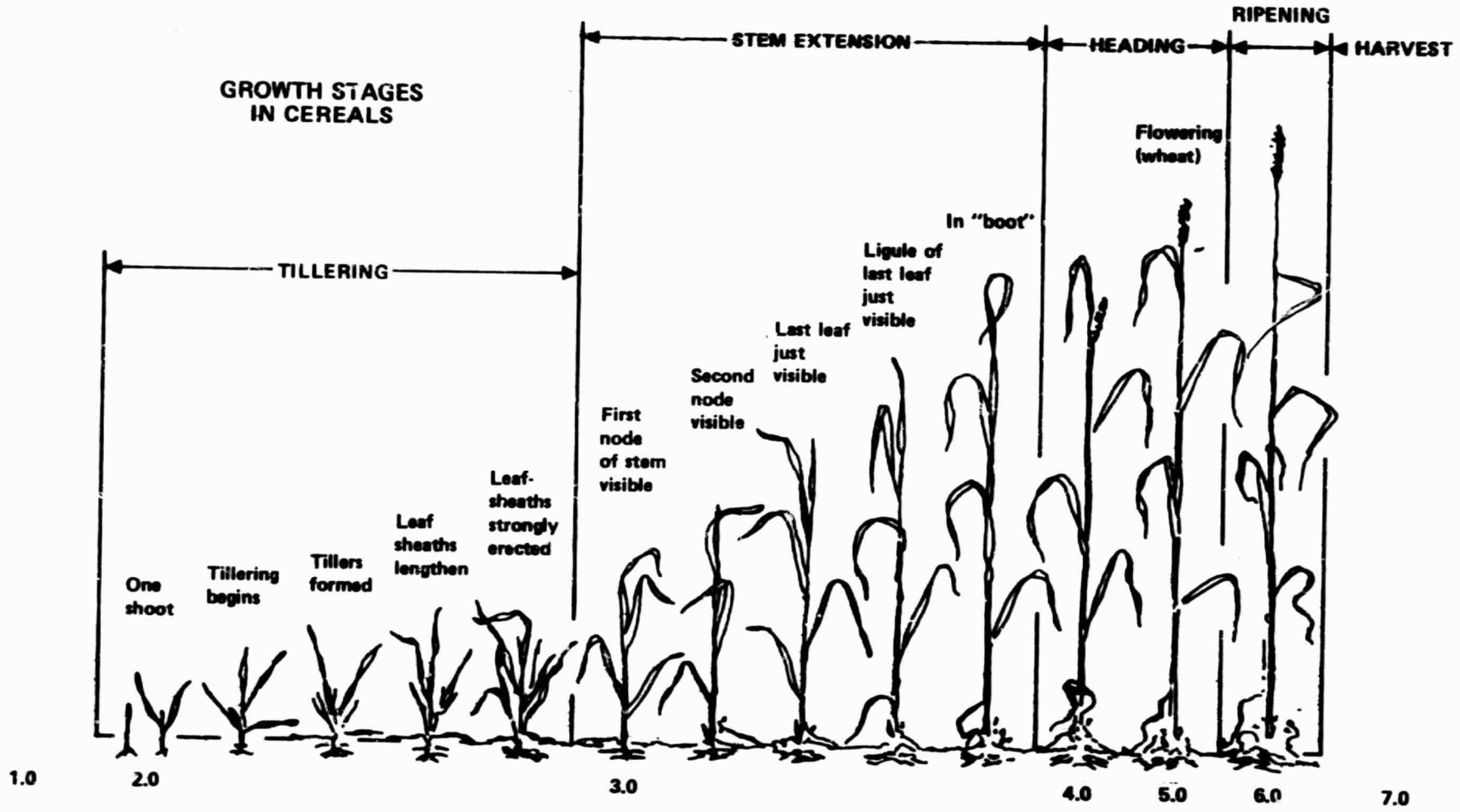
DATA SET

- FORTY-NINE SEGMENTS IN THE SPRING WHEAT AREAS OF THE U.S. GREAT PLAINS.
- 1979 PERIODIC OBSERVATIONS COLLECTED BY ENUMERATORS AT 9 TO 18 DAY INTERVALS CORRESPONDING TO LANDSAT OVERPASS DATES.



#3

ILLUSTRATION OF THE ROBERTSON PHENOLOGICAL SCALE

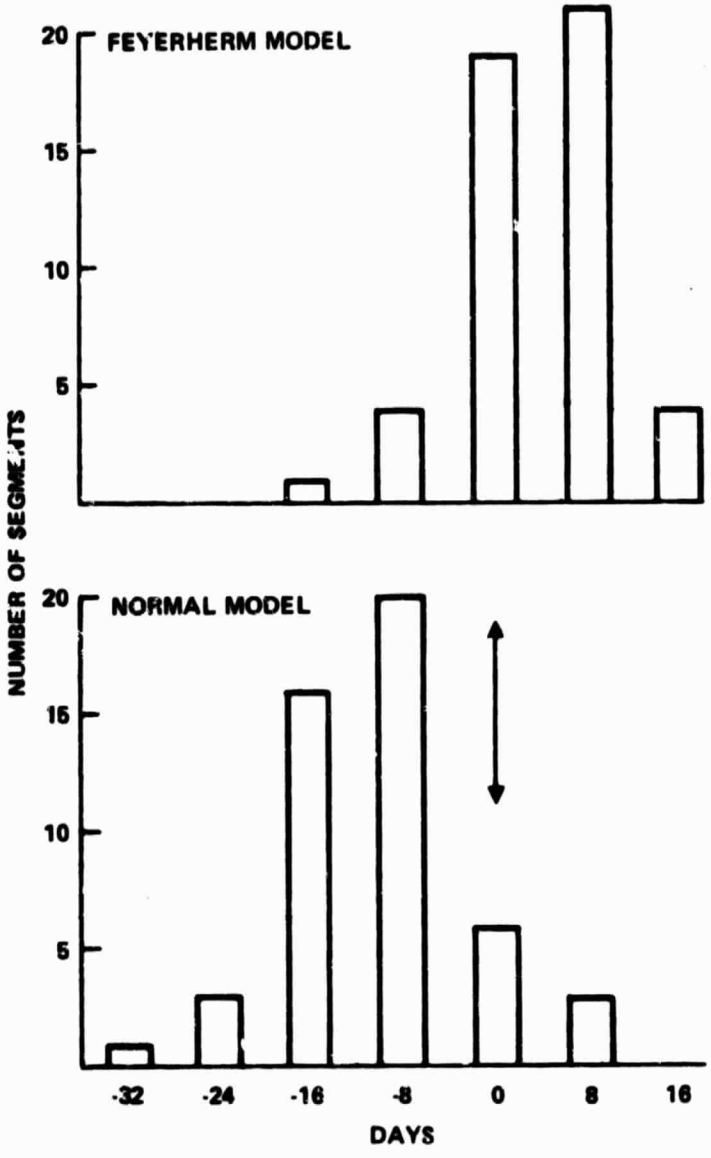


#3

PLANTING DATE MODEL RESULTS FOR SPRING WHEAT

+ OVERALL STATISTICS INDICATE THE FEYERHERM MODEL IS CLOSER TO GROUND TRUTH THAN NORMAL MODEL IN PREDICTING SPRING WHEAT PLANTING DATES.

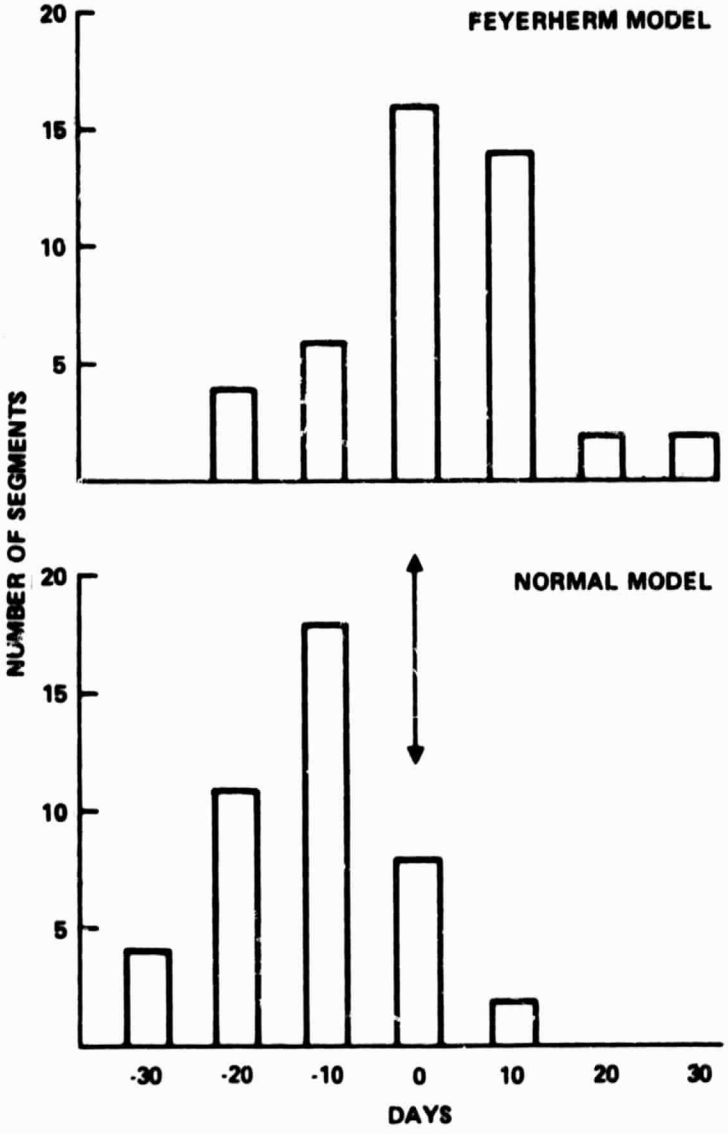
DISTRIBUTION OF ERRORS (IN DAYS) FOR THE FEYERHERM VS. THE NORMAL PLANTING DATE MODELS APPLIED TO SPRING WHEAT



PLANTING DATE MODEL RESULTS FOR BARLEY

+ OVERALL STATISTICS INDICATE THAT FEYERHERM IS CLOSER TO THE GROUND TRUTH THAN THE NORMAL IN PREDICTING BARLEY PLANTING DATES.

DISTRIBUTION OF ERRORS (IN DAYS) FOR THE FEYERHERM VS. THE NORMAL PLANTING DATE MODELS APPLIED TO BARLEY



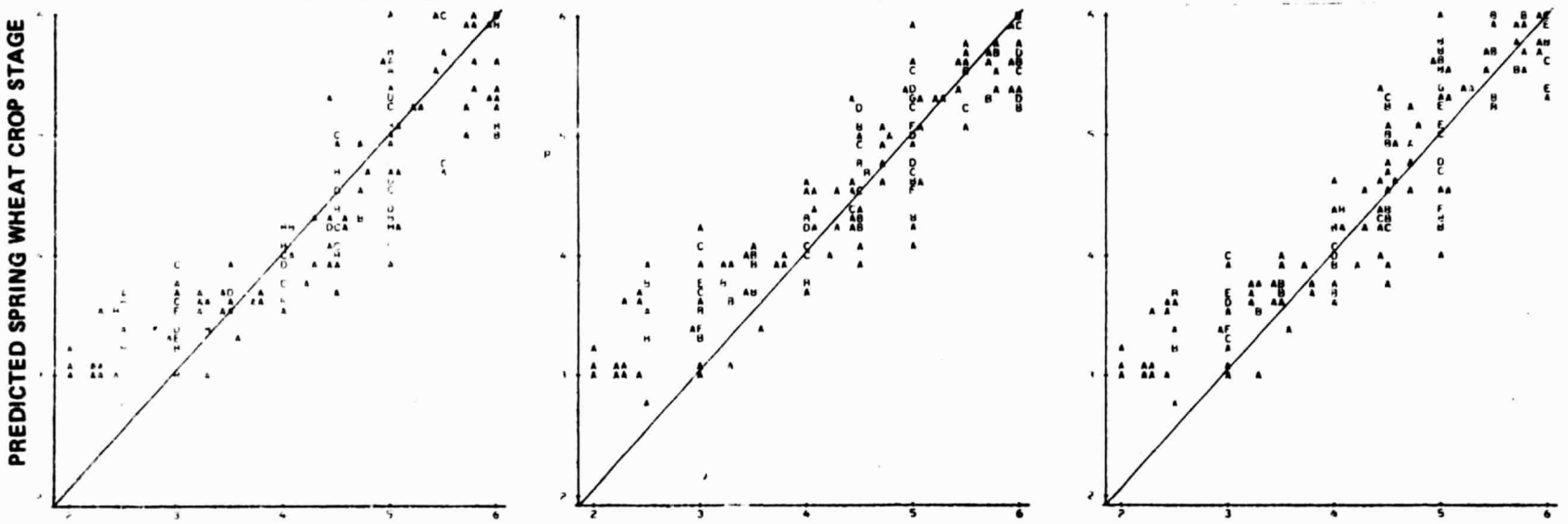
SPRING WHEAT CROP STAGE MODEL RESULTS

**OVERALL PERFORMANCE FROM STAGES 2.0 TO 6.0:
THERE WERE NO SIGNIFICANT DIFFERENCES BETWEEN
THE ROBERTSON MODEL OR ITS IMPROVEMENTS.**

**ORIGINAL ROBERTSON
(13 OBSERVATIONS GREATER THAN 6.0)**

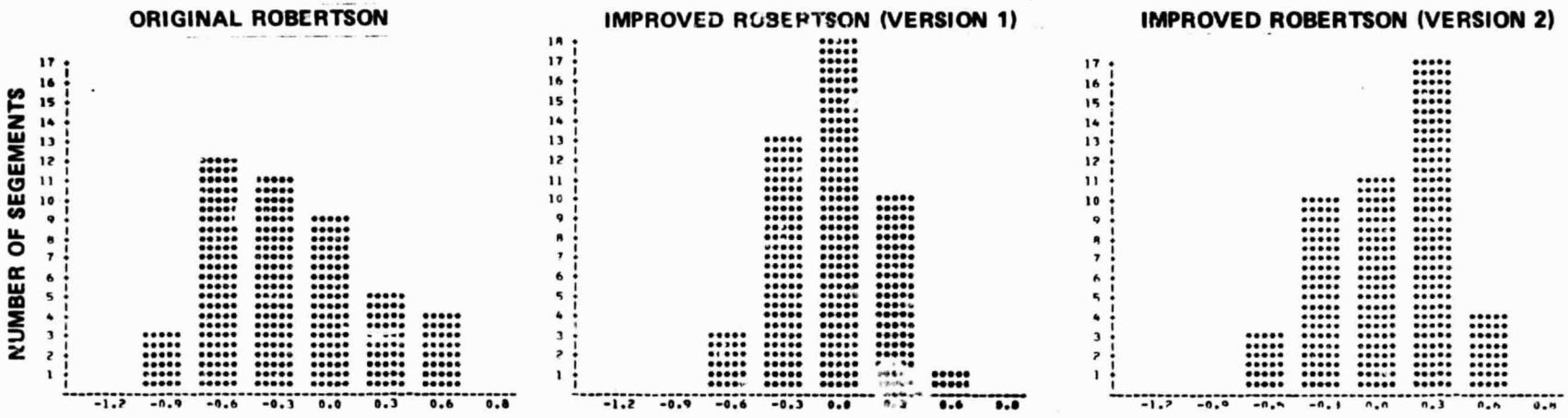
IMPROVED ROBERTSON (VERSION 1)

**IMPROVED ROBERTSON (VERSION 2)
(3 OBSERVATIONS GREATER THAN 6.0)**



#3

DISTRIBUTION OF CROP STAGE PREDICTION ERRORS FOR STAGES 5.0 - 5.9



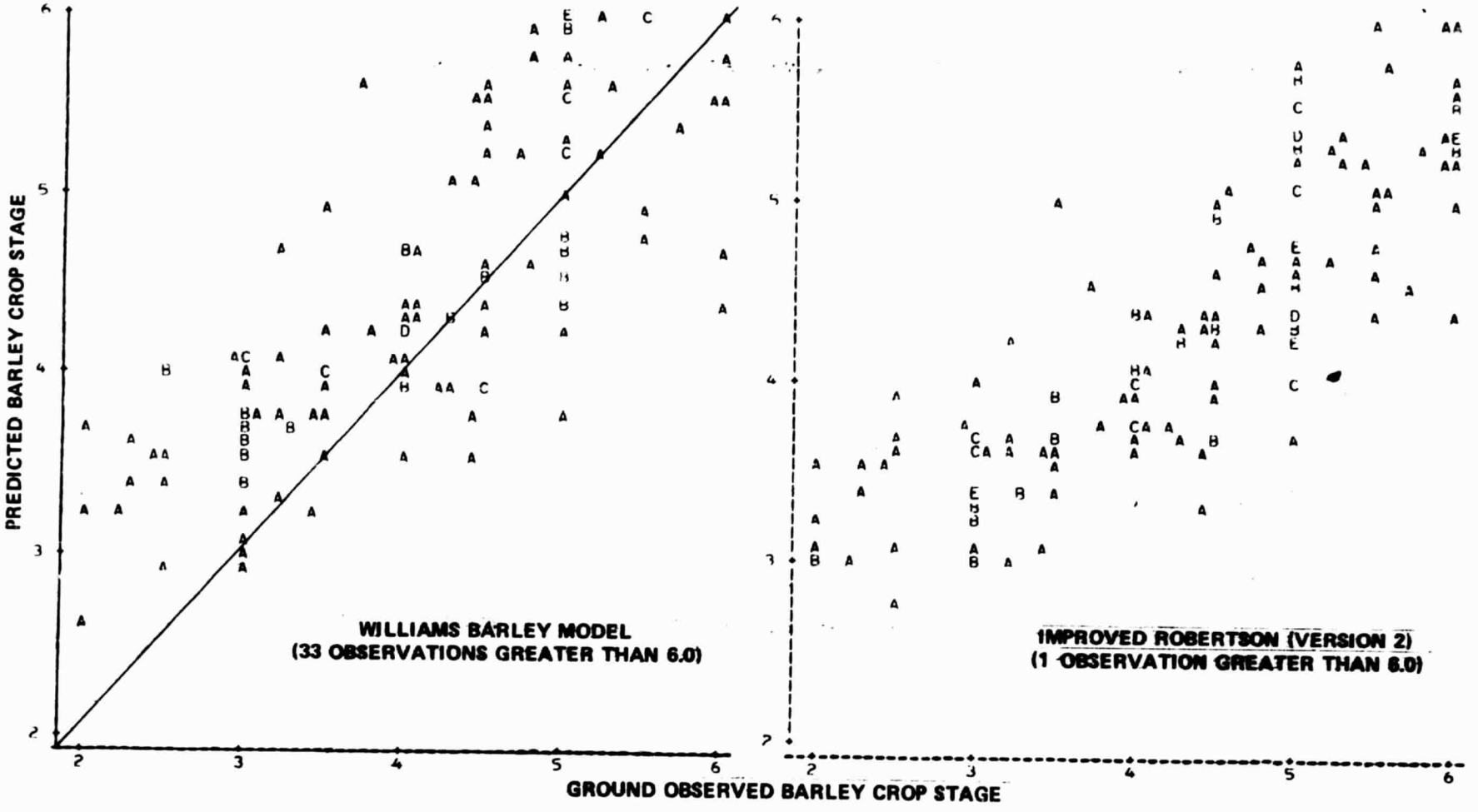
SPRING WHEAT CROP STAGE MODEL RESULTS (CONTINUED)

—IMPROVED ROBERTSON MODELS PERFORMED SIGNIFICANTLY BETTER THAN ROBERTSON MODEL FOR LATER STAGES (5.0 - 6.0)

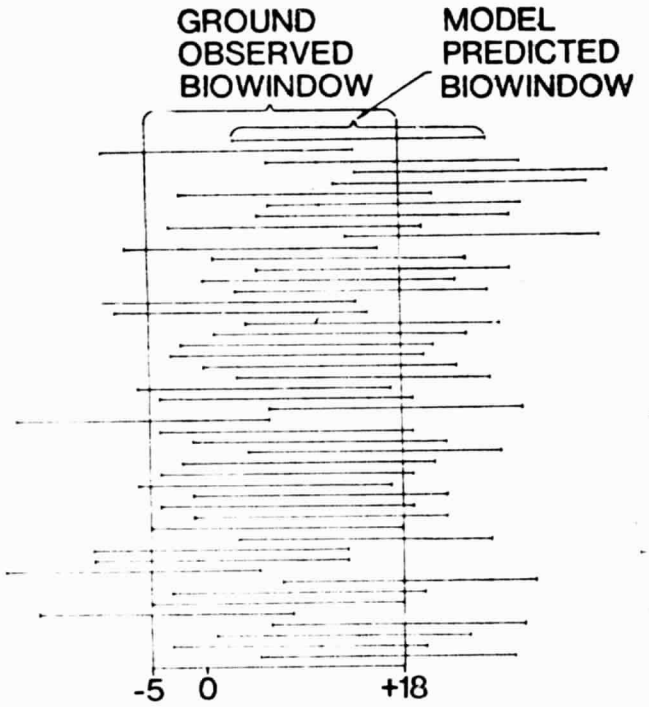
#3

BARLEY CROP STAGE MODEL RESULTS

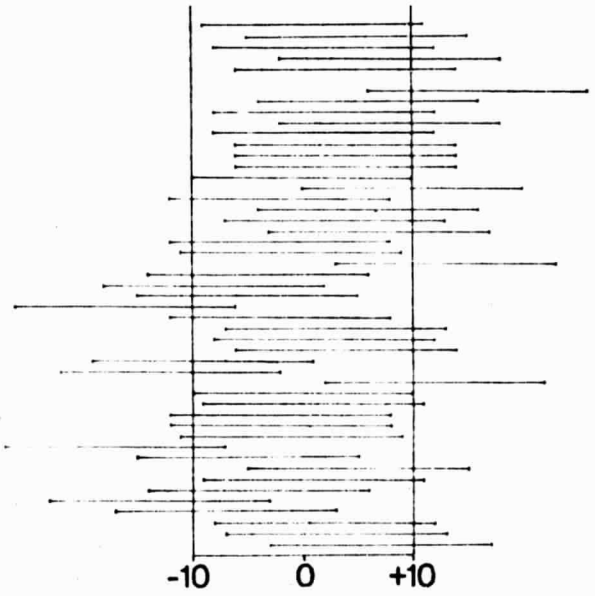
OVERALL PERFORMANCE (STAGES 2.0 - 6.0): ROBERTSON MODEL AND IMPROVED ROBERTSON MODELS PERFORMED SIGNIFICANTLY BETTER THAN THE WILLIAMS MODEL AT PREDICTING BARLEY CROP STAGES.



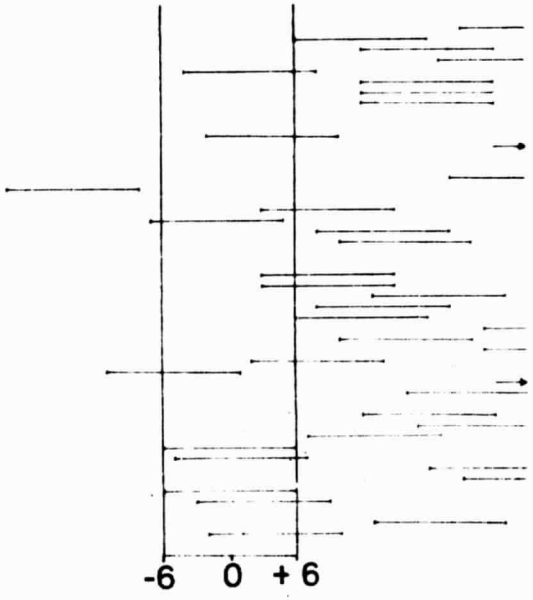
#3



BIOWINDOW 1 FOR SPRING WHEAT PLANTING



BIOWINDOW 2 FOR SPRING WHEAT HEADING



BIOWINDOW 3 FOR BARLEY RIPENING

#3

REFORMATTED PROCEDURE BIOWINDOW SELECTION RESULTS

+ FEYERHERM MODEL SELECTS DAYS IN BIOWINDOW 1 (SPRING WHEAT PLANTING) 73% OF THE TIME

+ IMPROVED ROBERTSON MODEL (VERSION 2) SELECTS DAYS IN BIOWINDOW 2 (SPRING WHEAT HEADING) 73% OF THE TIME AND SELECTS DAYS IN BIOWINDOW 3 (BARLEY RIPENING) ONLY 21% OF THE TIME

	BIOWINDOW 1 (Spring Wheat, Plant)	BIOWINDOW 2 (Spring Wheat, Head)	BIOWINDOW 3 (Barley, Ripe)
TOTAL PERCENT OUTSIDE WINDOW	27.0	27.0	79.0
PERCENT DAYS PAST THE WINDOW (MODEL LATE)	22.0	15.0	75.0
PERCENT DAYS BEFORE THE WINDOW (MODEL EARLY)	5.0	12.0	4.0
PROBABILITY OF BEING INSIDE WINDOW	73.0	73.0	21.0

#3

SUMMARY OF RESULTS

- FEYERHERM MODEL IS SIGNIFICANTLY BETTER THAN NORMAL FOR PREDICTING BOTH SPRING WHEAT AND BARLEY PLANTING DATES.
- OVERALL (FROM STAGES 2.0-6.0) THERE ARE NO SIGNIFICANT DIFFERENCES BETWEEN THE 3 MODELS FOR PREDICTING SPRING WHEAT CROP STAGES.
- IMPROVED ROBERTSON MODELS APPEAR TO BE BETTER THAN THE ORIGINAL MODEL AT LATER STAGES (5.0 - 6.0).
- WILLIAMS BARLEY MODEL IS WORSE THAN THE ROBERTSON MODELS FOR PREDICTING BARLEY GROWTH STAGES.
- NONE OF THE MODELS ARE ADEQUATE FOR PREDICTING THE BARLEY SEPARATION WINDOW (BIOWINDOW 3) FOR THE REFORMATTED PROCEDURE.

#3

RECOMMENDATIONS

- USE THE FEYERHERM PLANTING DATE MODEL FOR BOTH SPRING WHEAT AND BARLEY.
- USE THE IMPROVED ROBERTSON VERSION 2 MODEL FOR SPRING WHEAT.
- RETEST ALL MODELS OVER SEVERAL YEARS OF GROUND TRUTH CONDITIONS.
- NEED A BETTER MODEL FOR IDENTIFYING BIOWINDOW 3 (BARLEY RIPENING) OF THE REFORMATTED PROCEDURE.
- SENSITIVITY STUDIES NEED TO BE PERFORMED FOR ANY PROCEDURES USING THESE CROP CALENDARS AS INPUT.

#3

U. S. CORN/SOYBEANS EXPLORATORY EXPERIMENTS

+ CLASSIFICATION PROCEDURES VERIFICATION TEST

+ SIMULATED AGGREGATION TEST
  - SEGMENT LEVEL PERFORMANCE

  - LARGE AREA LEVEL PERFORMANCE

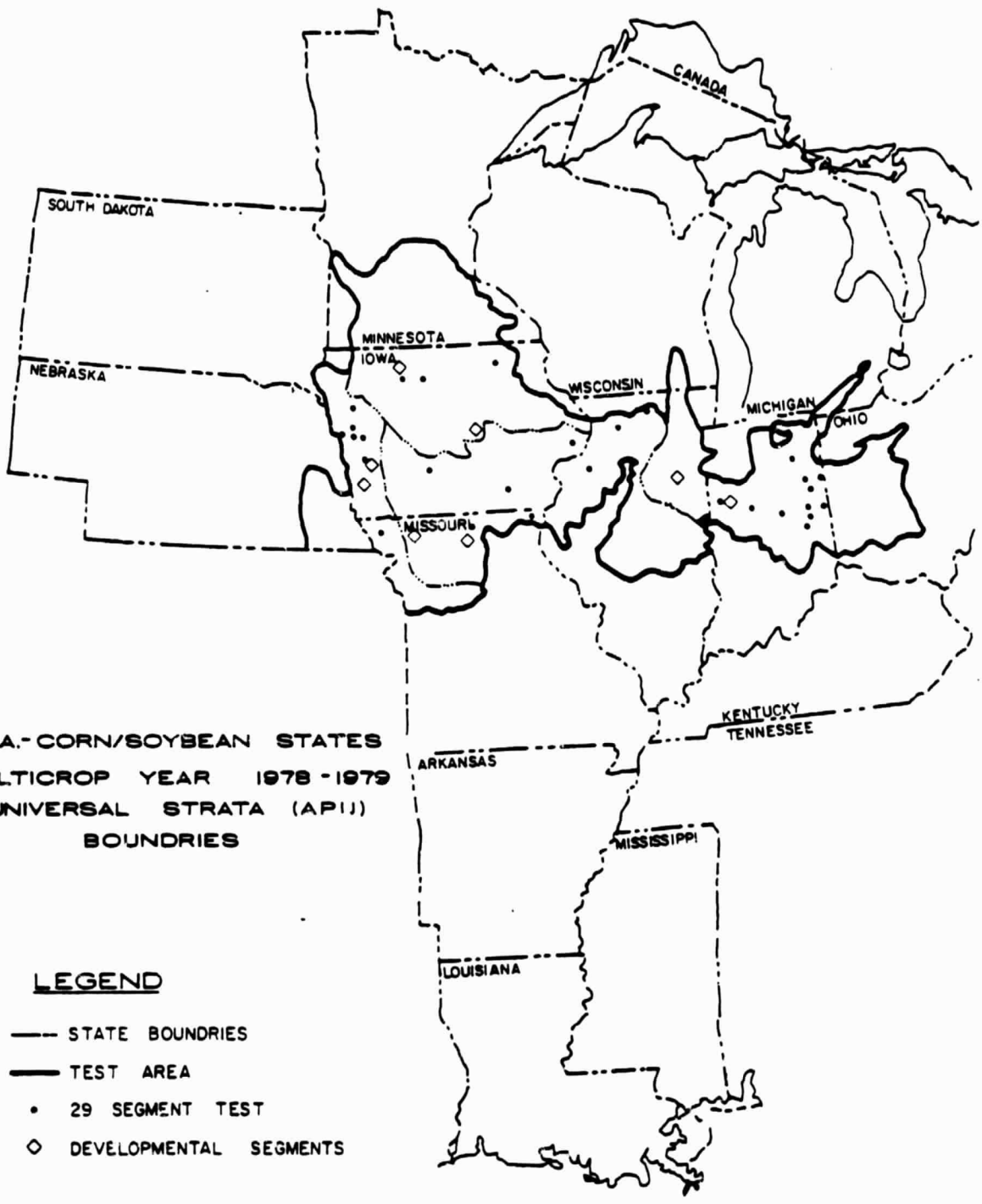
ATTACHMENT #4

U.S. CORN/SOYBEANS — CLASSIFICATION PROCEDURES VERIFICATION TEST

- FIRST EVALUATION OF LACIE-LIKE TECHNOLOGY APPLIED TO NEW CROP REGION (CORN/SOYBEANS - U. S. CORNBELT)
- INITIAL DEVELOPMENT AND IMPLEMENTATION OF HIERARCHICAL OBJECTIVE LABELING LOGIC

#4

CORNBELT PROCEDURES VERIFICATION TEST



SUMMARY OF RESULTS - CLASSIFICATION PROCEDURES VERIFICATION TEST

- RESULTS (FULL SEASON DATA)
  - CORN PROPORTION ESTIMATES WERE BIASED LOW (RD = -10.1%; GT = 38%)
  - SOYBEAN PROPORTION ESTIMATES WERE BIASED LOW (RD = -20.7%; GT = 28%)
  - TYPE 2 LABELING ERRORS ACCOUNTED FOR THE BIAS
  - TYPE 1 (PURE PIXELS) ERRORS PRIMARILY PROCEDURAL

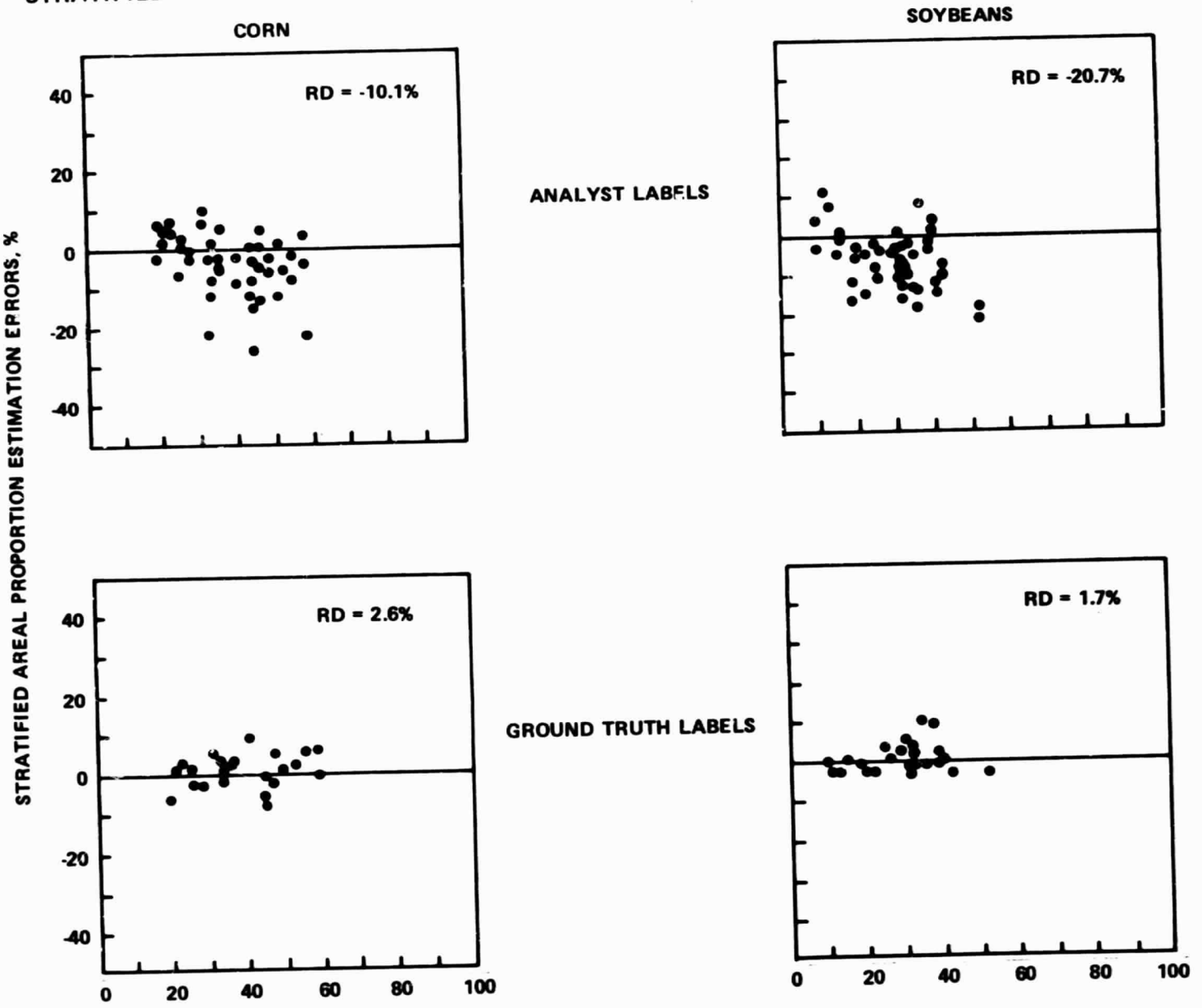
GROUND TRUTH CATEGORY	PERCENT CORRECTLY LABELED	
	TYPE 1 DOTS	TYPE 2 DOTS
CORN	86	73
SOYBEANS	79	64
OTHER	93	86
ALL CATEGORIES	86	75

  - RESULTS ARE COMPARABLE TO SMALL GRAIN LABELING ACCURACIES ACHIEVED IN LACIE

#4

SUMMARY OF RESULTS - CLASSIFICATION PROCEDURES VERIFICATION TEST

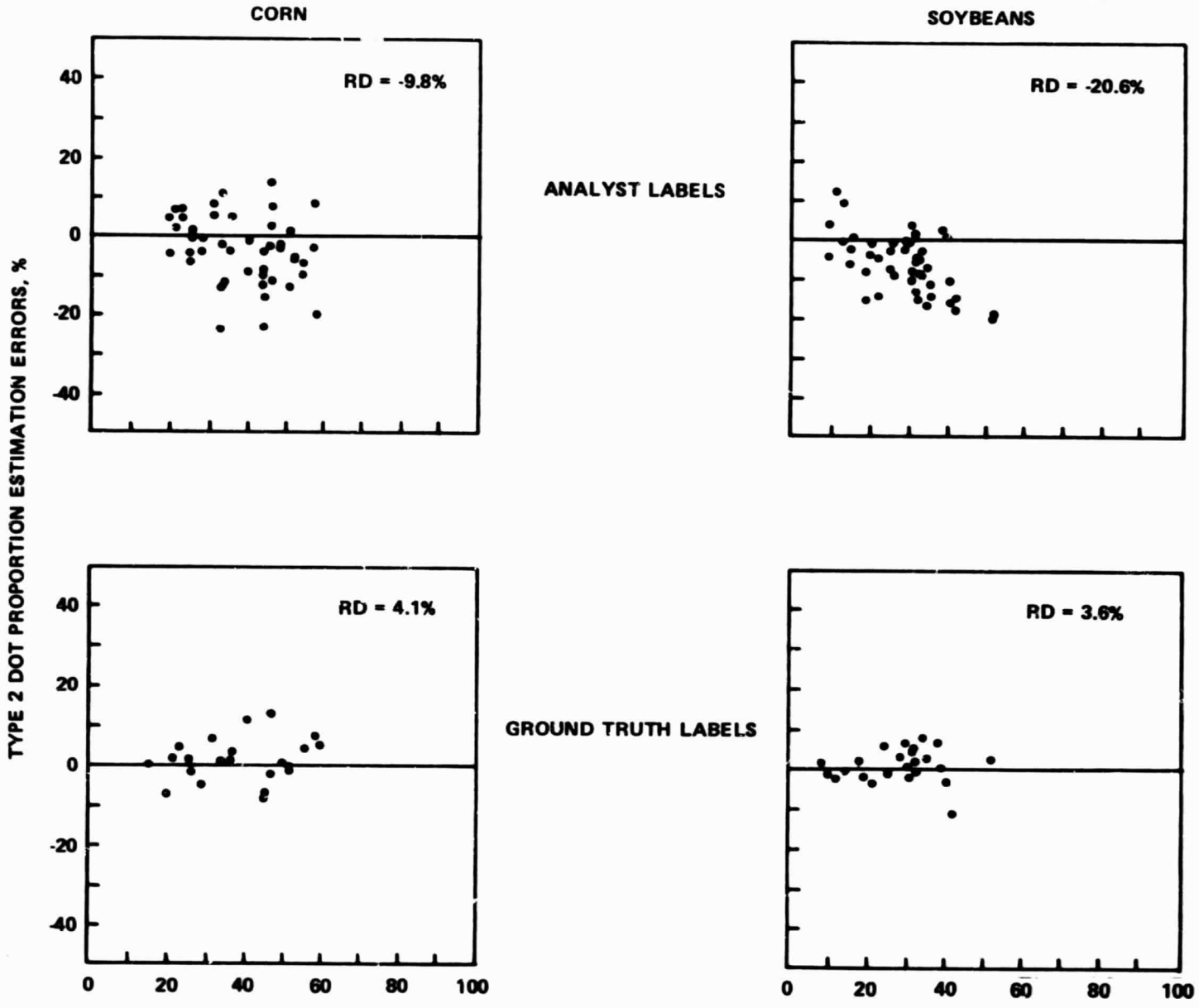
STRATIFIED AREAL PROPORTION ESTIMATION ERRORS VS. GROUND-OBSERVED PROPORTION



#4

SUMMARY OF RESULTS - CLASSIFICATION PROCEDURES VERIFICATION TEST

TYPE 2 DOT PROPORTION ESTIMATION ERRORS VS. GROUND-OBSERVED PROPORTION



#4

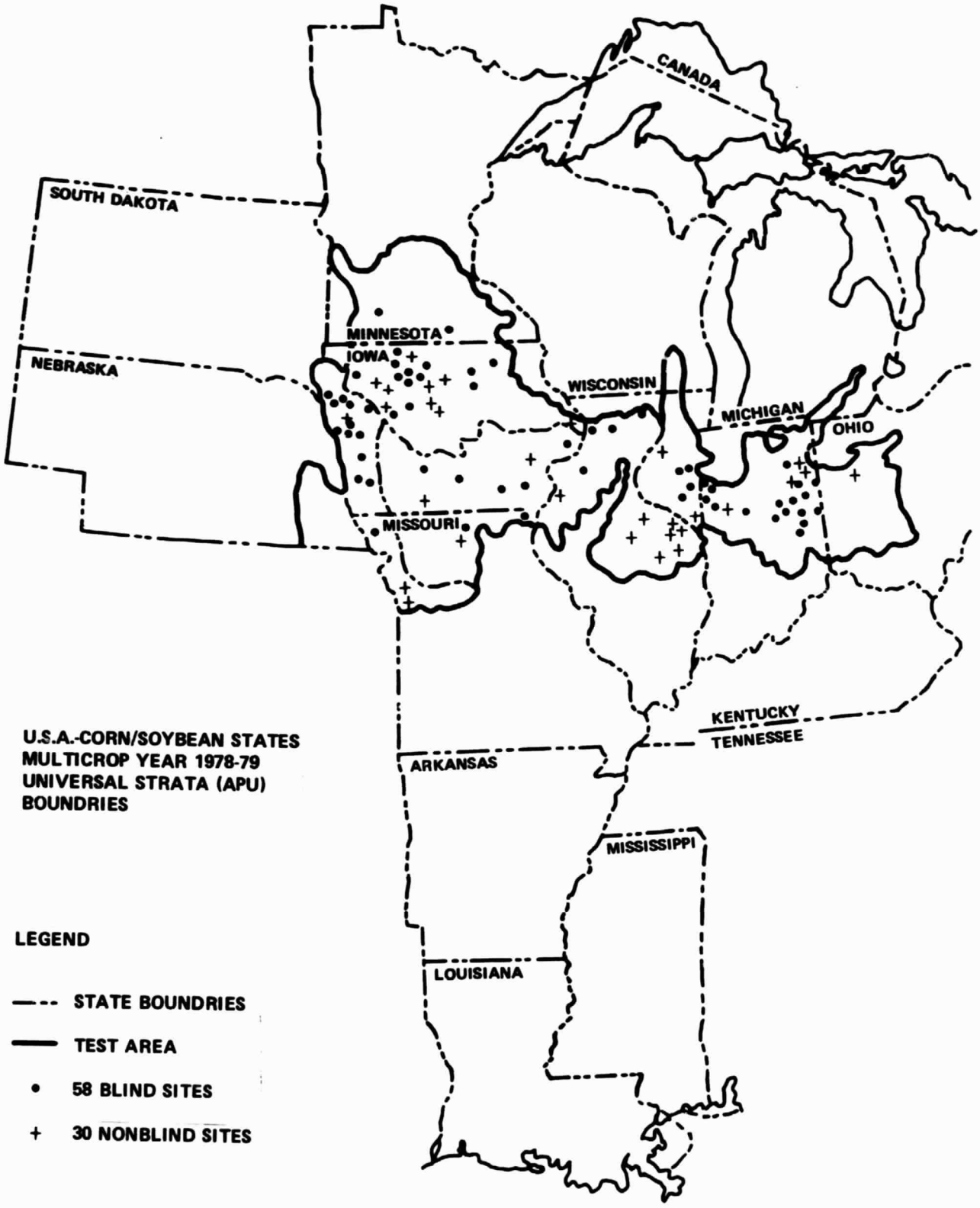
U.S.CORN/SOYBEANS - SIMULATED AGGREGATION TEST

OBJECTIVES:

- TO DETERMINE LABELLING AND PROPORTION ESTIMATION ACCURACY
  - ONLY TYPE I DOTS LABELED
  - PROPORTION ESTIMATES OBTAINED VIA CLUSTERING AND CLASSIFICATION
- TO EVALUATE THE MULTICROP AREA AND PRODUCTION AGGREGATION APPROACH
  - EVALUATE SAMPLING AND CLASSIFICATION ERROR COMPONENTS
  - ASSESS SENSITIVITY TO NONRESPONSE

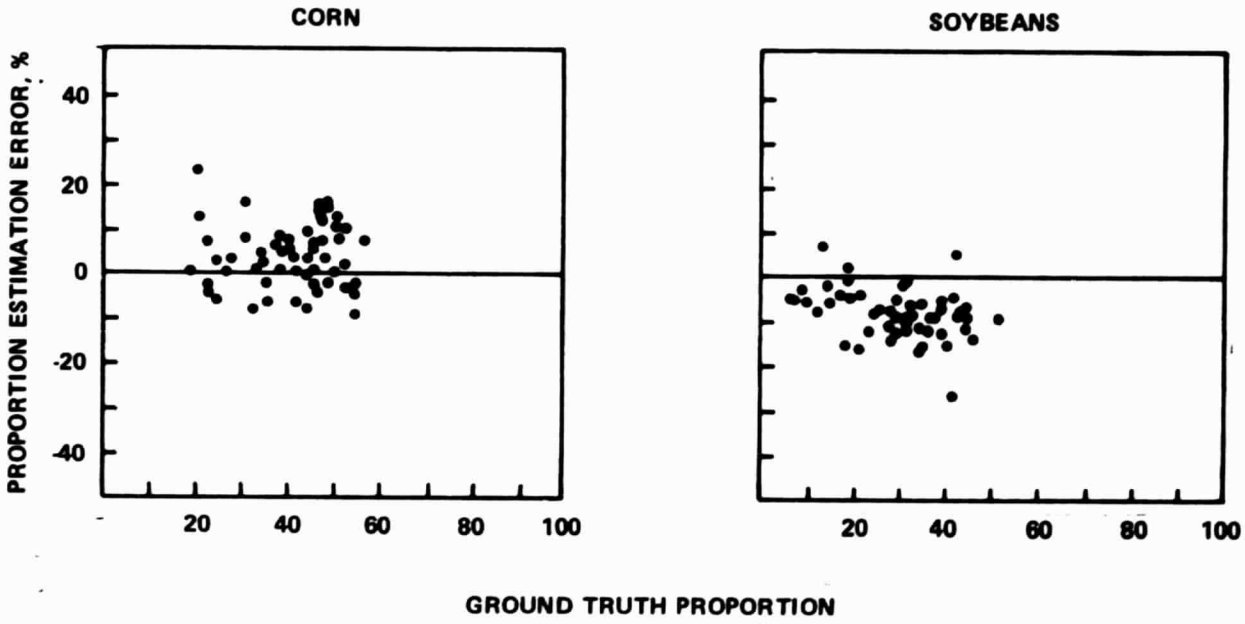
#4

SIMULATED AGGREGATION TEST



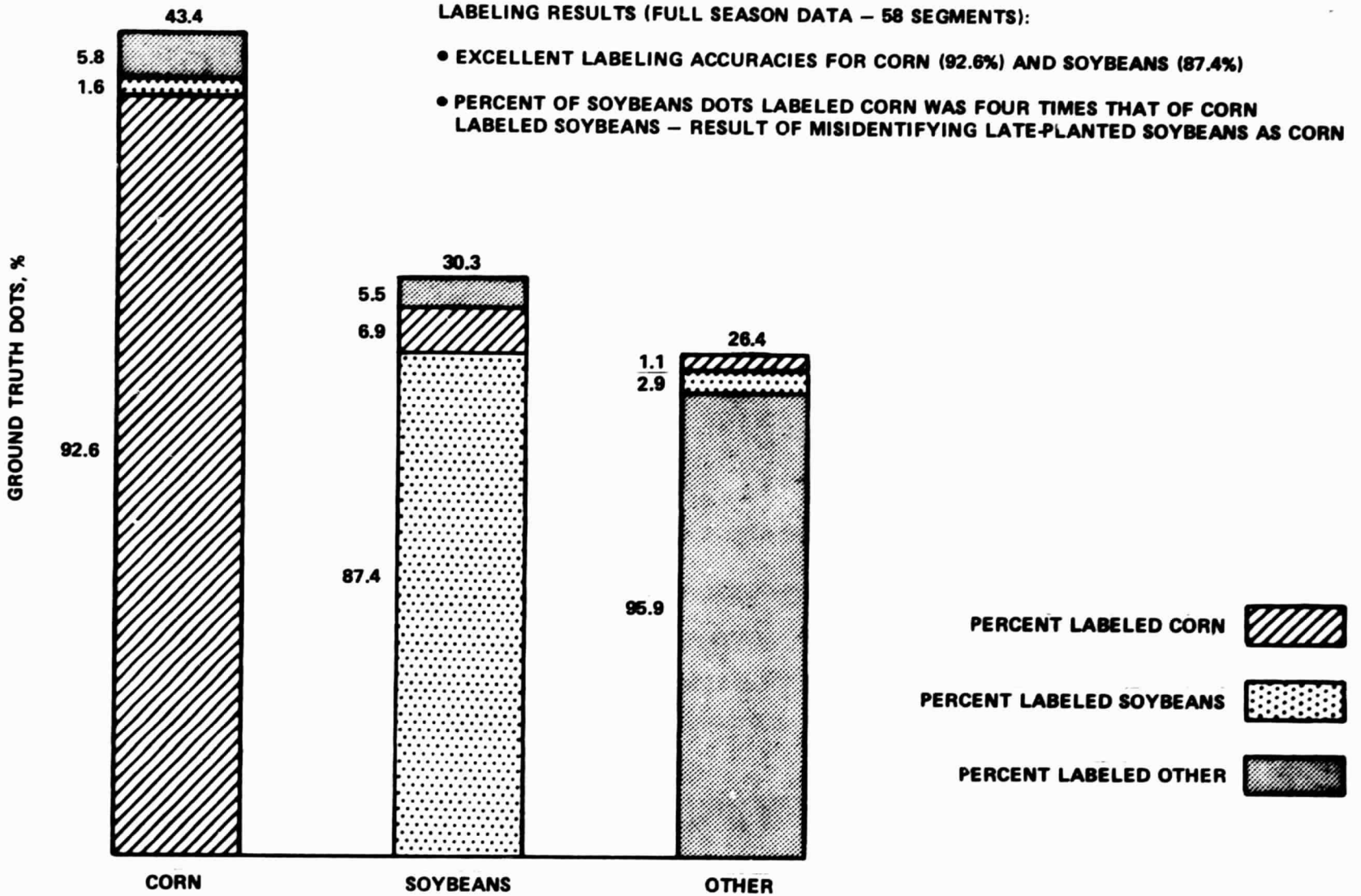
SUMMARY OF RESULTS - SIMULATED AGGREGATION TEST

- PROPORTION ESTIMATION RESULTS (FULL SEASON DATA – 58 SEGMENTS)
  - CORN PROPORTION ESTIMATES BIASED HIGH (RD = 11.3%; GT = 40.6%)
  - SOYBEAN PROPORTION ESTIMATES BIASED LOW (RD = -26.3%; GT = 29.7%)



#4

SUMMARY OF RESULTS - SIMULATED AGGREGATION TEST



#4

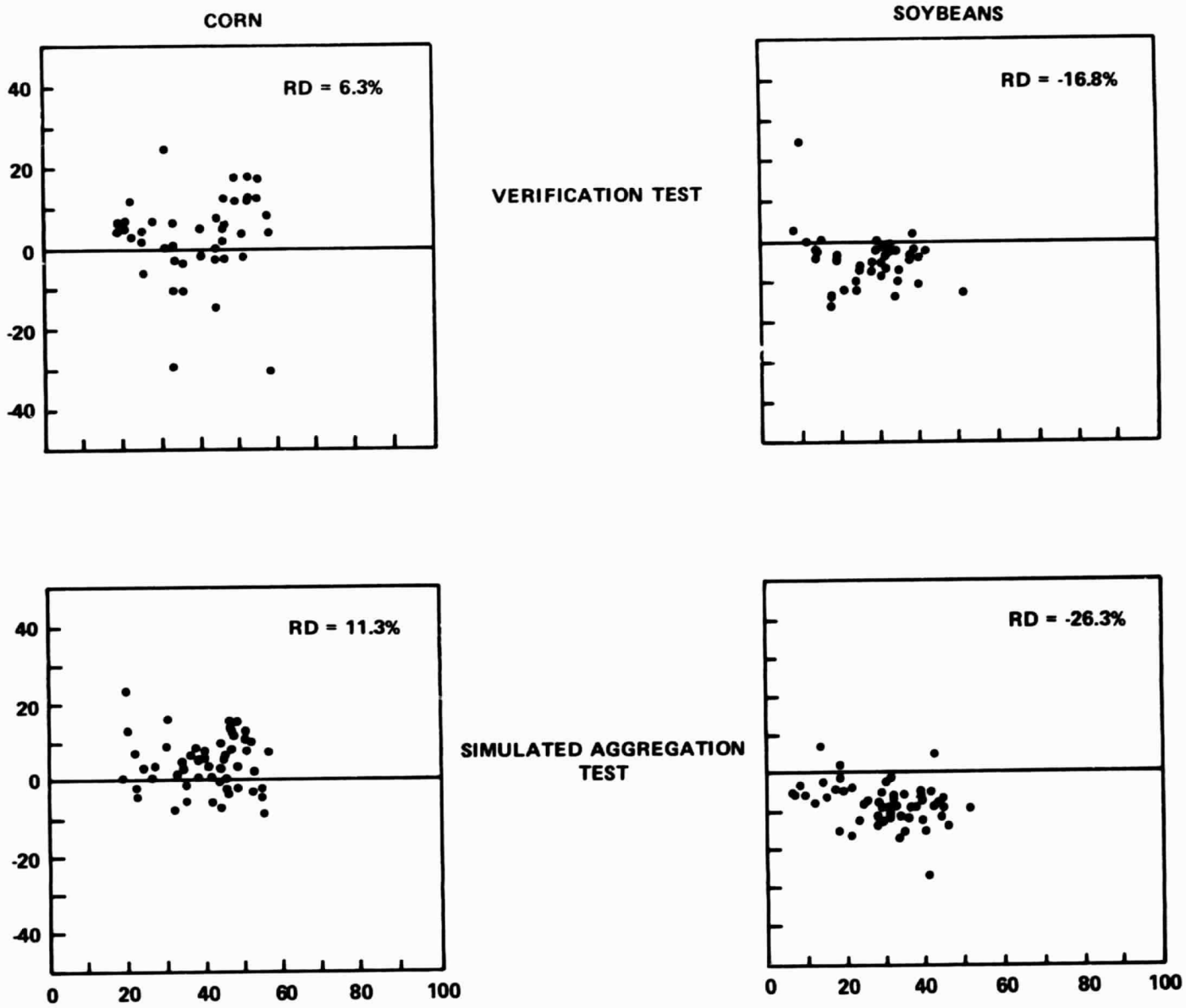
SUMMARY OF RESULTS - SIMULATED AGGREGATION TEST

- COMPARISON WITH VERIFICATION TEST RESULTS
  - + CLASSIFICATION - BASED PROPORTION ESTIMATION ERRORS WERE NOT SIGNIFICANTLY DIFFERENT FOR CORN; BUT WERE SIGNIFICANTLY LARGER FOR SOYBEANS
  - + INCREASE IN CORN AND SOYBEAN LABELING ACCURATE, THOUGH NOT STATISTICALLY SIGNIFICANT

	LABELING (% CORRECT)		
	CORN	SOYBEANS	OTHER
VERIFICATION TEST	86	79	93
SIMULATED AGGREGATION TEST	93	88	96

#4

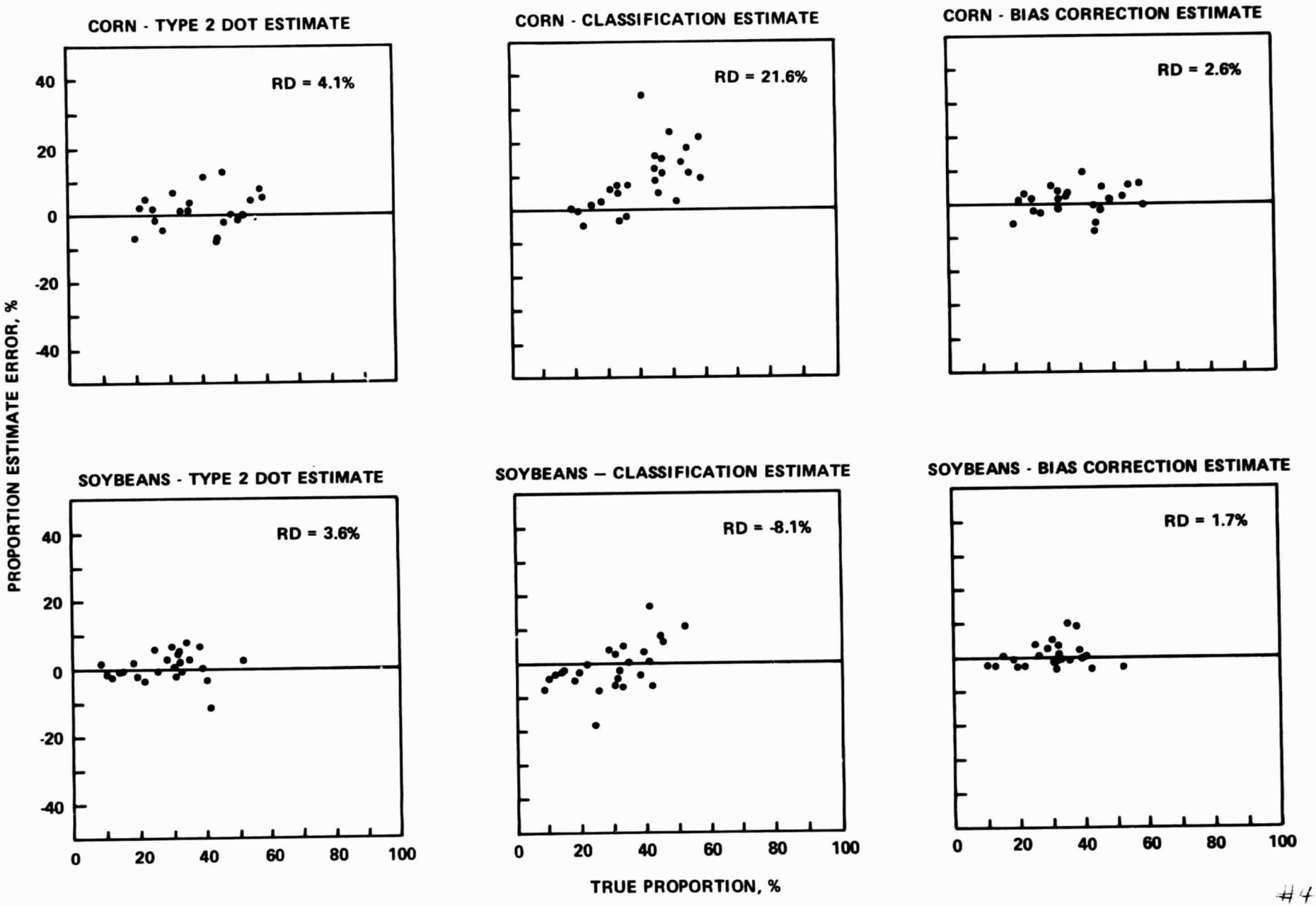
COMPARISON OF CLASSIFICATION PROPORTION ESTIMATION ERROR VS. GROUND OBSERVED PROPORTION



#4

CLASSIFICATION PROCEDURES VERIFICATION TEST RESULTS

PROPORTION ESTIMATES USING GROUND TRUTH LABELING AS INPUT



#4

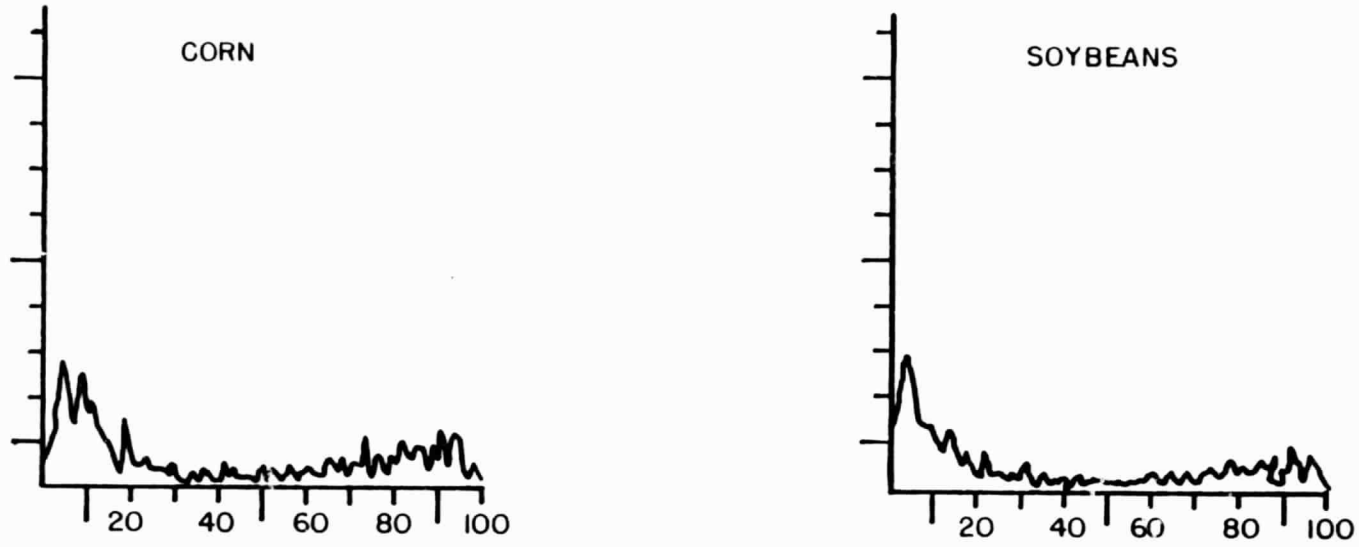
SUMMARY OF RESULTS — PIXEL PURITY CLASSIFICATION EFFECTS

- CLUSTER PURITY HISTOGRAMS SHOW INCREASE IN NUMBERS OF PURE CLUSTERS WHEN ONLY PURE PIXELS ARE CONSIDERED
- CORRESPONDING INCREASE IN PERCENTAGE CORRECTLY CLASSIFIED
- BIAS INTRODUCED IF ONLY PURE PIXELS ARE USED FOR PROPORTION ESTIMATION

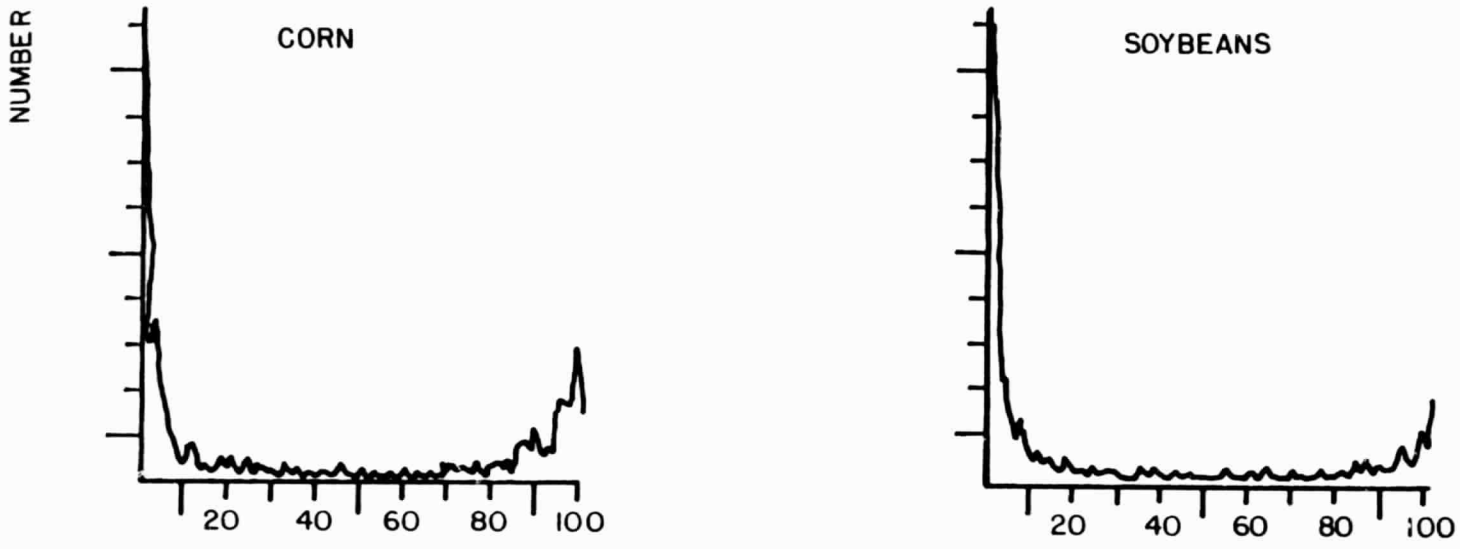
#4

CLUSTER PURITY HISTOGRAMS

FOR ENTIRE SCENE



FOR PURE PIXELS

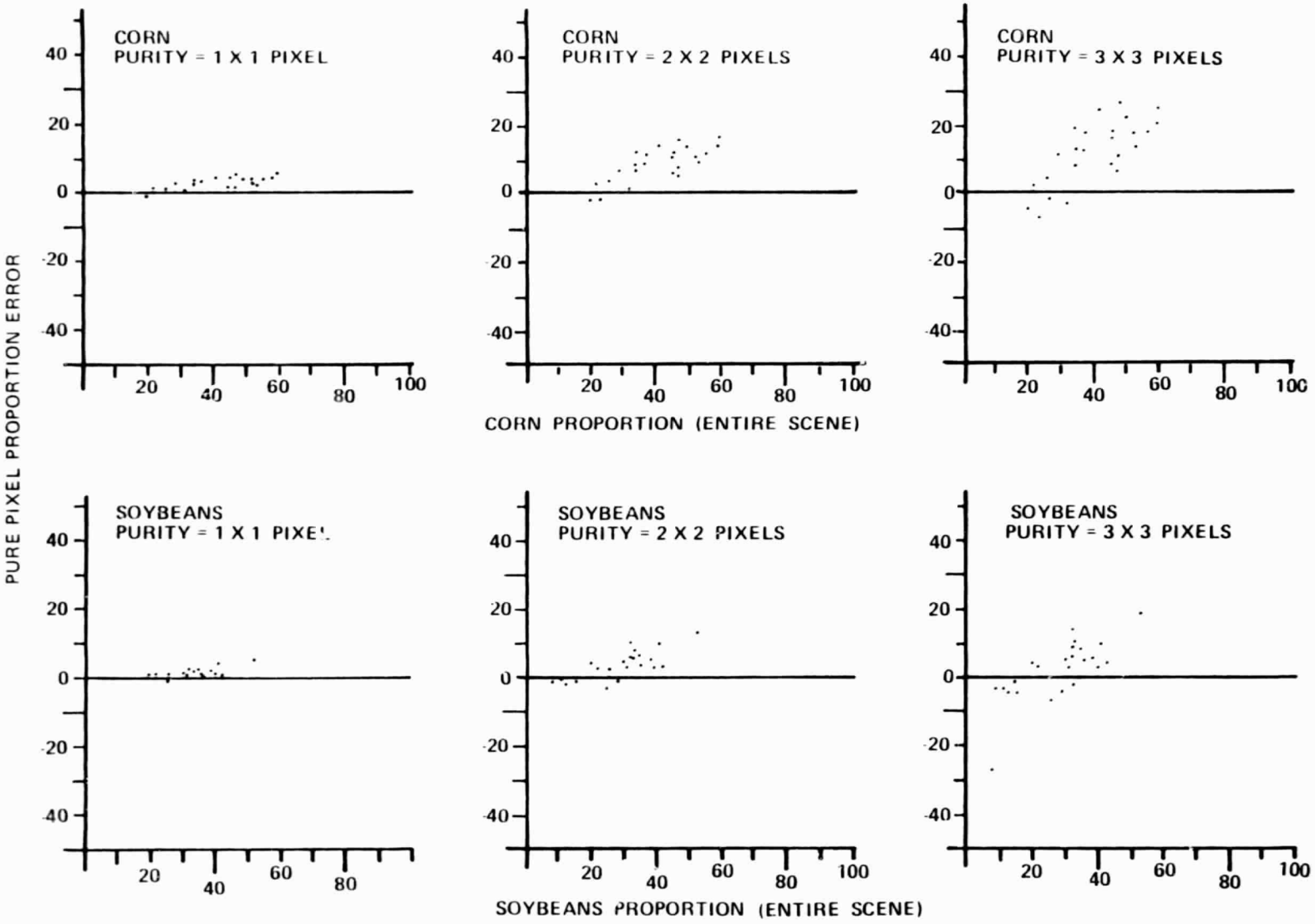


PERCENTAGE OF CORRECT CLASSIFICATION FOR ENTIRE SCENE AND FOR PURE PIXELS (PROCEDURE I CLASSIFICATION)

	PERCENTAGE OF CORRECT CLASSIFICATION	
	ENTIRE SCENE	PURE PIXELS
CORN	79	89
SOYBEANS	65	79
OTHER	56	68
OVERALL	72	86

#4

PROPORTION ERRORS WHEN ONLY PURE PIXELS ARE USED TO DETERMINE THE PROPORTIONS



U. S. CORN/SOYBEANS EXPLORATORY EXPERIMENTS - SUMMARY OF RESULTS

- EXCELLENT LABELLING OF CORN/SOYBEAN IN U.S. CORN BELT (88-93% ACCURACY NEAR HARVEST)
- QUANTIFIED NEED FOR MACHINE PROCESSING TO TREAT BOUNDARY PIXELS
- IMPROVED PERFORMANCE EXPECTED IN REGIONS OF LARGE HOMOGENEOUS FIELDS

#4

U.S. CORN/SOYBEANS EXPLORATORY EXPERIMENTS
CONCLUSIONS

+ CORN/SOYBEANS DECISION LOGIC WAS EASILY LEARNED AND IMPLEMENTED BY BOTH EXPERIENCED AND INEXPERIENCED ANALYSTS

+ HIERARCHICAL APPROACH LENDS ITSELF TO R & D AND QA AS ERRORS IN LOGIC ARE EASILY IDENTIFIED

+ INCONSISTENCIES OCCURRED WHEN LOGIC REQUIRED COLOR AND SPATIAL DETERMINATIONS.

+ LABELING ERRORS OCCURRED DUT TO LATE AND EARLY PLANTING, DOUBLE CROPPING AND OTHER DEVIATIONS FROM NORMAL CROP GROWTH CYCLE.

U.S. CORN/SOYBEANS EXPLORATORY EXPERIMENTS RECOMMENDATIONS

+ INVESTIGATE TRANSFERABILITY OF HIERCHICAL APPROACH TO OTHER REGIONS (FOR CORN/SOYBEANS) AND OTHER CROPS.

+ INVESTIGATE OBJECTIVE SPATIAL AND SPECTRAL ALGORITHMS AS REPLACEMENTS FOR ANALYST COLOR AND SPATIAL DETERMINATIONS IN THE DECISION LOGIC

+ INVESTIGATE MODIFICATIONS TO THE LOGIC TO ACCOUNT FOR DEVIATIONS FROM NORMAL CROP GROWTH CYCLE

+ INVESTIGATE ALTERNATIVE PROPORTION ESTIMATION TECHNIQUES TO TREAT BOUNDARY PIXELS

U.S. CORN/SOYBEANS EXPLORATORY EXPERIMENTS
OUTLOOK

+ EXPECT EXCELLENT LABELING OF PURE CORN AND SOYBEAN PIXELS UNDER THE CONDITIONS OF
  - FULL SEASON DATA
  - CENTRAL CORN BELT ENVIRONMENT

+ EXPECT MACHINE PROCESSING APPROACH THAT ERIM IS PURSUING TO EFFECTIVELY DEAL WITH BOUNDARY PIXEL PROBLEM

#4

SIMULATED AGGREGATION TEST

OBJECTIVE: TO TEST THE ALLOCATION AND AGGREGATION COMPONENTS OF THE AgRISTARS PRODUCTION ESTIMATION SYSTEM

APPROACH: FOR EACH CONFIGURATION OF CROP/ACQUISITION RATE, AGGREGATE SIMULATED YIELD AND ACREAGE ESTIMATES, REPEAT FOR A TOTAL OF 100 ITERATIONS, THEN EXAMINE RESULTING CV'S AND BIASES OF LARGE AREA ACREAGE AND PRODUCTION ESTIMATES

SCOPE: ILLINOIS, INDIANA, IOWA - 1978

EXPERIMENTAL DESIGN:

2 CROPS (CORN, SOYBEANS)

5 ACQUISITION RATES (10%, 25%, 50%, 75%, 100%)

DEPENDENT VARIABLES:

BIAS AND CV OF ACREAGE AND PRODUCTION ESTIMATES

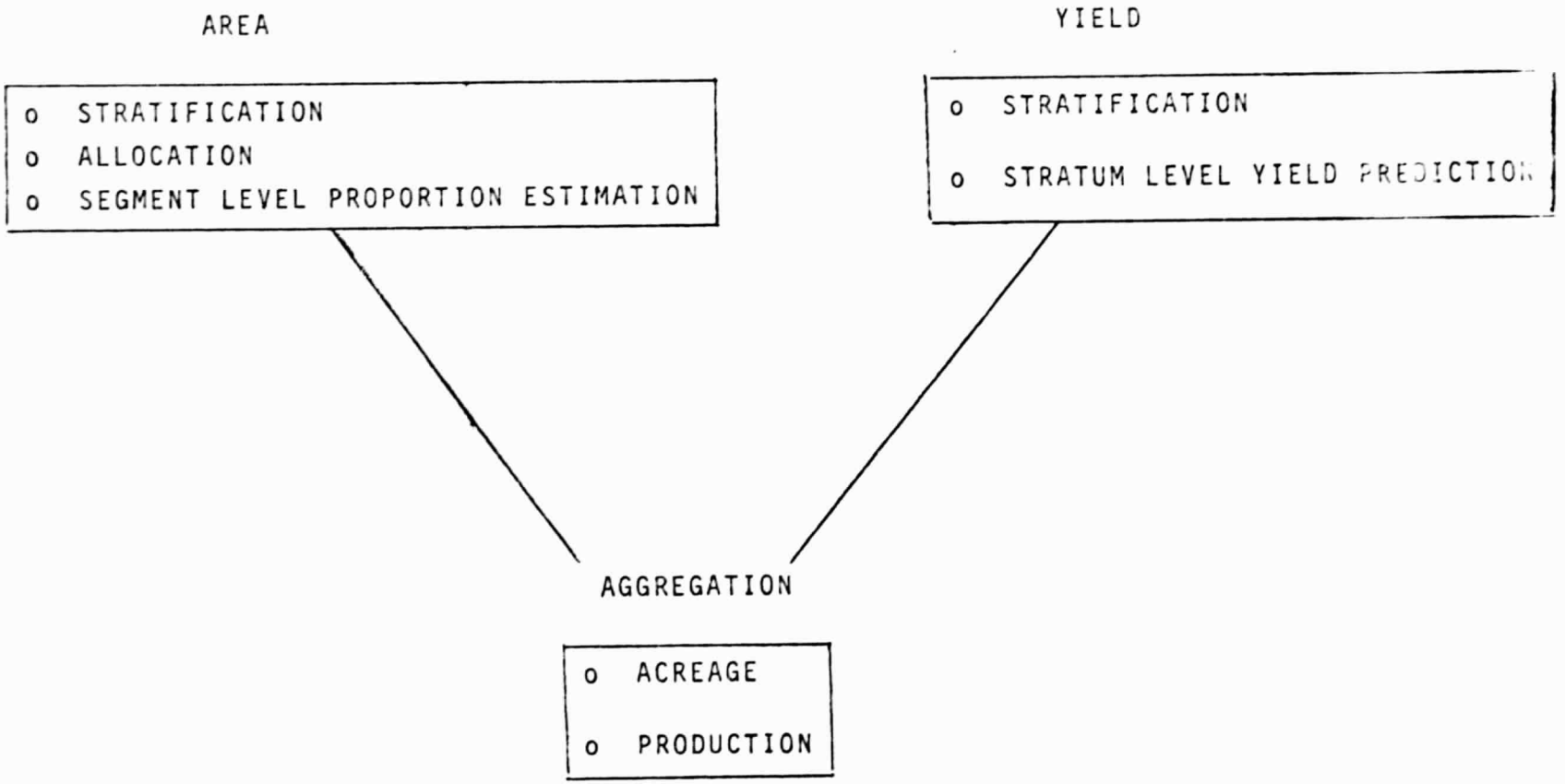
ATTACHMENT #5

WHY SIMULATE?

SIMULATION

- PROVIDES A MEANS OF CHECKING AGGREGATION THEORY AND SOFTWARE
- GIVES GOOD INDICATION OF HOW VARIOUS COMPONENTS OF THE PRODUCTION ESTIMATION SYSTEM AFFECT THE FINAL PRODUCTION ESTIMATE
- CAN BE USED TO GET AN IDEA OF WHAT ACCURACY WE MIGHT EXPECT IN A NEW CROP/REGION EXPERIMENT BEFORE ACTUAL RANDOM SAMPLES ARE ANALYZED ON A LARGE SCALE
- CAN BE USED TO GET AN IDEA OF WHAT SORT OF YEAR-TO-YEAR VARIATION WE MIGHT EXPECT, AT BEST, REAL SAMPLES ARE TAKEN ONLY FOR TWO OR THREE YEARS IN ANY REGION DURING AgRISTARS

AgRISTARS PRODUCTION ESTIMATION SYSTEM



#5

WEIGHTED AGGREGATION PROCEDURE

- MAKES THE BEST POSSIBLE USE OF HISTORICAL DATA FOR STABILIZING PRODUCTION ESTIMATES IN REGIONS WHERE THERE IS A HIGH RATE OF DATA LOSS OR WHERE THERE MAY BE LARGE CLASSIFICATION ERRORS.

- IN LACIE, CROP ACREAGE FOR REGIONS WITH MISSING DATA WAS ESTIMATED BY RATIOING TO HISTORICAL DATA OVER AN ARBITRARY REGION.

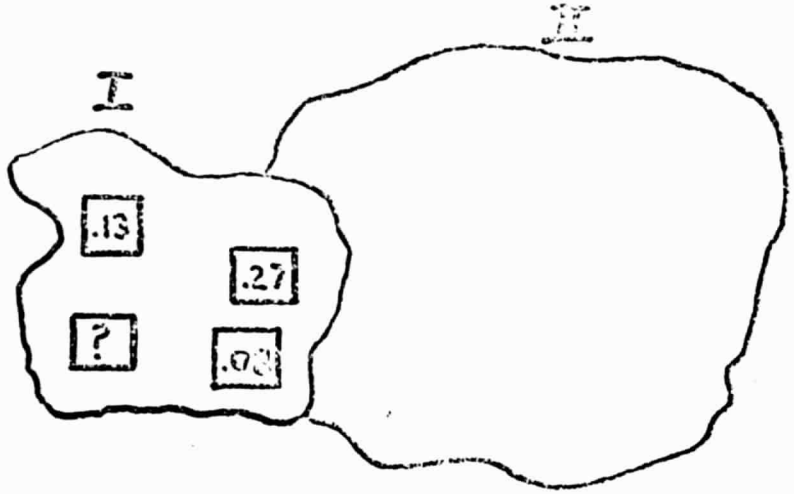
- IN AgRISTARS, THE WEIGHTED AGGREGATION PROCEDURE EXAMINES THE HISTORICAL DATA TO FIND THE BEST REGION OVER WHICH TO RATIO

- IN LACIE, A DIRECT ESTIMATE WAS USED TO REPRESENT A STRATUM IN THE AGGREGATION EVEN IF DATA FROM ONLY ONE SEGMENT WAS AVAILABLE IN THAT STRATUM

- IN AgRISTARS, EVERY STRATUM ESTIMATE IS A WEIGHTED AVERAGE BETWEEN ITS DIRECT AND RATIO ESTIMATES WHERE THE WEIGHTS DEPEND ON THE RELATIVE ACCURACY BETWEEN THE TWO TYPES OF ESTIMATES

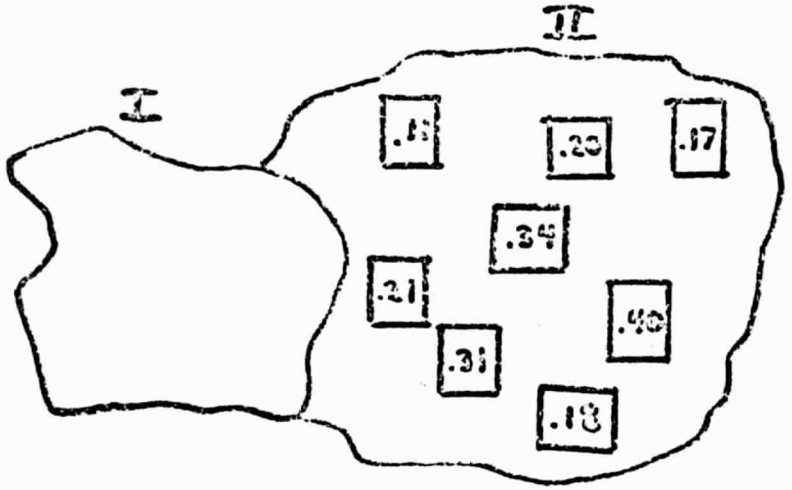
#5

DIRECT ESTIMATE



$$\hat{P}_D = \frac{1}{3}\,(.13+.08+.27) - .16$$

RATIO ESTIMATE



HISTORICAL DATA

YEAR	P_{II}	P_I
1975	.10	.04
1976	.15	.07
1977	.17	.10

$$\hat{P}_R = \frac{1}{2}\,(\hat{P}_{II}) = .12$$

$$\hat{P}_{II}(\text{DIRECT}) = \frac{1}{8}(.11+.20+.....40)$$

WEIGHTED ESTIMATE

$$\hat{P} = w\,\hat{P}_D + (1-w)\,\hat{P}_R$$

$$= w\,(.16) + (1-w)\,(.12)$$

MONTE CARLO SIMULATION

1. PARTITION 3-STATE AREA INTO 12 ACREAGE STRATA
2. ALLOCATE 204 SEGMENTS TO THE 12 STRATA
3. SIMULATE 100 LARGE-AREA (STATE, 3-STATES) PRODUCTION AND ACREAGE ESTIMATES

DO THIS 100 TIMES

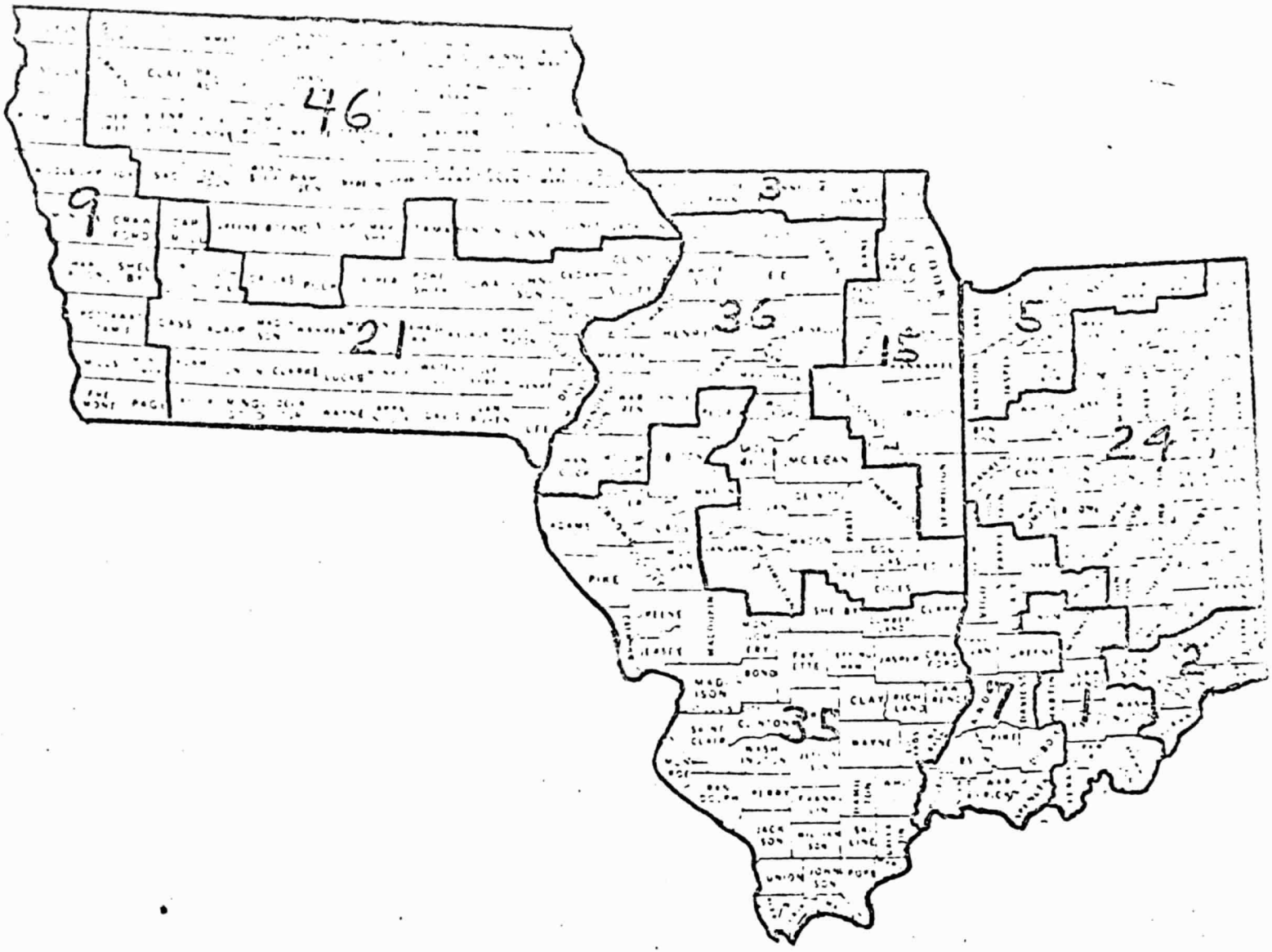
   a. RANDOMLY DECIDE WHICH SEGMENTS ARE "LOST" DUE TO CLOUD COVER
   b. FOR EACH ACREAGE STRATUM WITH AT LEAST ONE REMAINING SEGMENT, GENERATE AN ACREAGE ESTIMATE
   c. FOR EACH STATE, GENERATE A YIELD ESTIMATE
   d. COMPUTE: $\hat{P} = f_1(\hat{A}_1, \ldots \hat{A}_{12}, y_{ILL}, y_{IND}, y_{IOWA})$ = PRODUCTION ESTIMATE

      $\hat{A} = f_2(\hat{A}_1, \ldots \hat{A}_{12})$ = ACREAGE ESTIMATE

4. SAVE VALUES FOR FURTHER ANALYSIS

$$\begin{matrix} \hat{P}_1 \\ \vdots \\ \hat{P}_{100} \end{matrix} \qquad \begin{matrix} \hat{A}_1 \\ \vdots \\ \hat{A}_{100} \end{matrix}$$

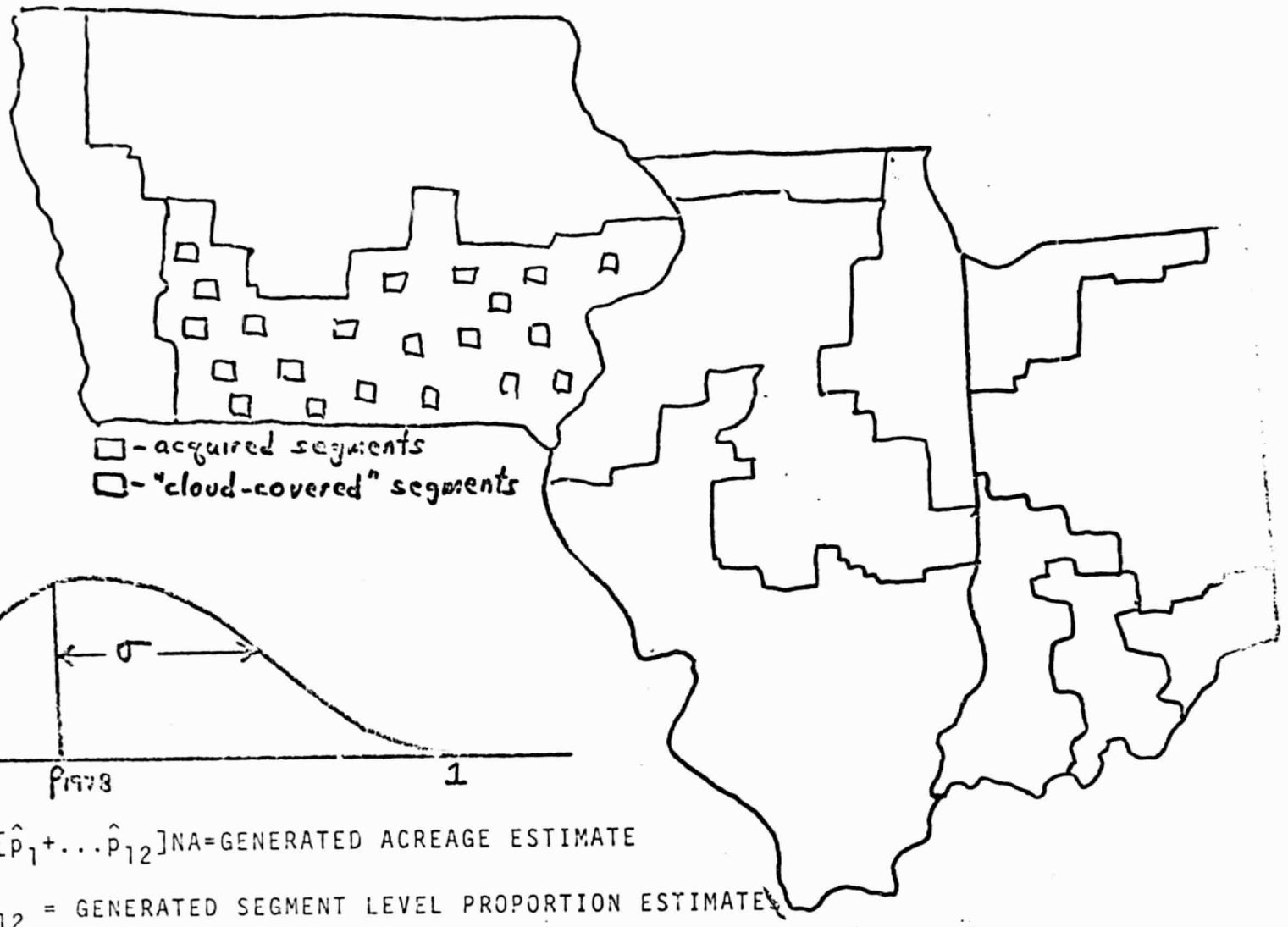
#5



3 - STATE SIMULATION REGION SHOWING 12 ACREAGE STRATA AND THE ORIGINAL SAMPLE ALLOCATION

#5

GENERATION OF STRATUM LEVEL ACREAGE ESTIMATES



$\hat{A} = \frac{1}{12} [\hat{p}_1 + \ldots \hat{p}_{12}]NA$=GENERATED ACREAGE ESTIMATE

$\hat{p}_1, \ldots \hat{p}_{12}$ = GENERATED SEGMENT LEVEL PROPORTION ESTIMATES

p_{1978}=ESCS CROP PROPORTION (1978)

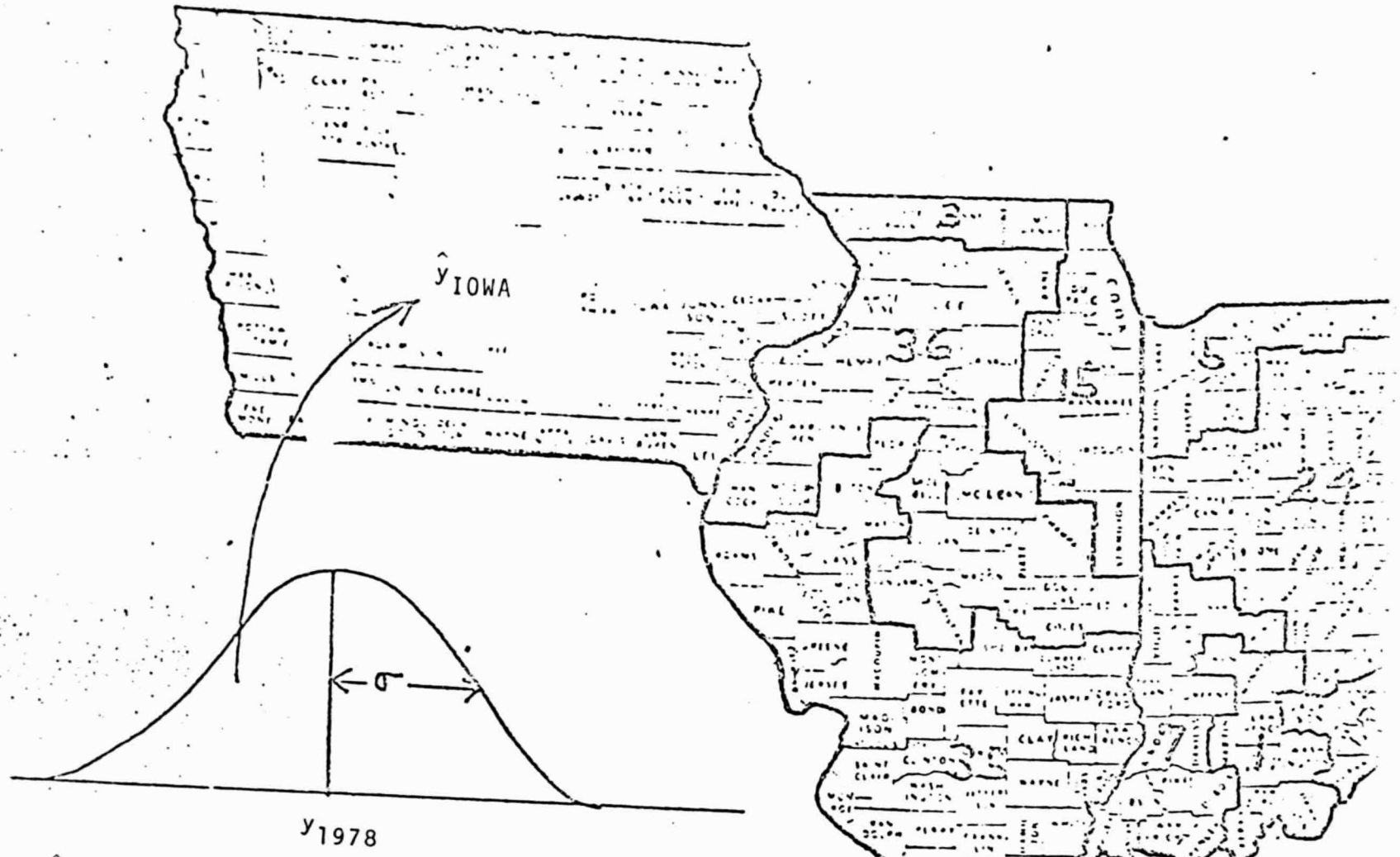
$\sigma = \sqrt{\sigma_c^2 + \sigma_s^2} = \sqrt{(\text{CLASSIFICATION VARIANCE}) + (\text{SAMPLING VARIANCE})}$

σ_c^2=CLASSIFICATION VARIANCE ESTIMATED FROM EXPLORATORY SEGMENTS

σ_s^2=A-PRIORI ESTIMATES OF SAMPLING VARIANCE

N = TOTAL POPULATION OF SEGMENTS (OF WHICH 21 WERE SELECTED)
A = PHYSICAL AREA OF A SEGMENT

GENERATION OF STATE-LEVEL YIELD PREDICTIONS



$\hat{y}_{IOWA}$ = GENERATED STATE YIELD PREDICTION

y_{1978} = 1978 ESCS YIELD

σ = CCEA ESTIMATE OF ROOT-MEAN-SQUARE PREDICTION ERROR FOR YIELD

ALLOCATION

PREMISE: MULTICROP ALLOCATION SHOULD PROVIDE A MAXIMUM CV OF 5% FOR THE PRODUCTION ESTIMATE AT THE COUNTRY LEVEL FOR EACH CROP OF INTEREST

RESULTS:

CROP	PRODUCTION	CV
CORN	3.403×10^9 BU.	.047
SOYBEANS	7.300×10^8 BU.	.052

#5

AGGREGATION

- o ACREAGE
- o PRODUCTION

PREMISES:

1. ESTIMATES SHOULD HAVE LITTLE OR NO PROCEDURAL BIAS
2. VARIANCE (CV'S) SHOULD BE REASONABLE
3. ESTIMATES OF VARIANCES (CV'S) SHOULD BE CORRECT
4. ESTIMATES SHOULD BE ROBUST AGAINST LOSS OF DATA

RESULTS:

100% ACQUISITION RATE (204 SEGMENTS)

	STATE	TRUE PROD.(BU.)	REL. BIAS	CV	AVG EST CV
CORN	ILL	1.220×10^9	-.001	.060	.053
	IND	6.280×10^8	.000	.071	.068
	IOWA	1.555×10^9	.001	.071	.064
	3-STATE	3.403×10^9	.000	.047	.040
SOYBEANS	ILL	3.033×10^8	.003	.070	.075
	IND	1.401×10^8	-.007	.087	.096
	IOWA	2.866×10^8	.000	.092	.085
	3-STATE	7.300×10^8	.000	.052	.053

#5

RESULTS:
(CONT.)

EFFECT OF ACQUISITION RATE ON RELATIVE BIAS

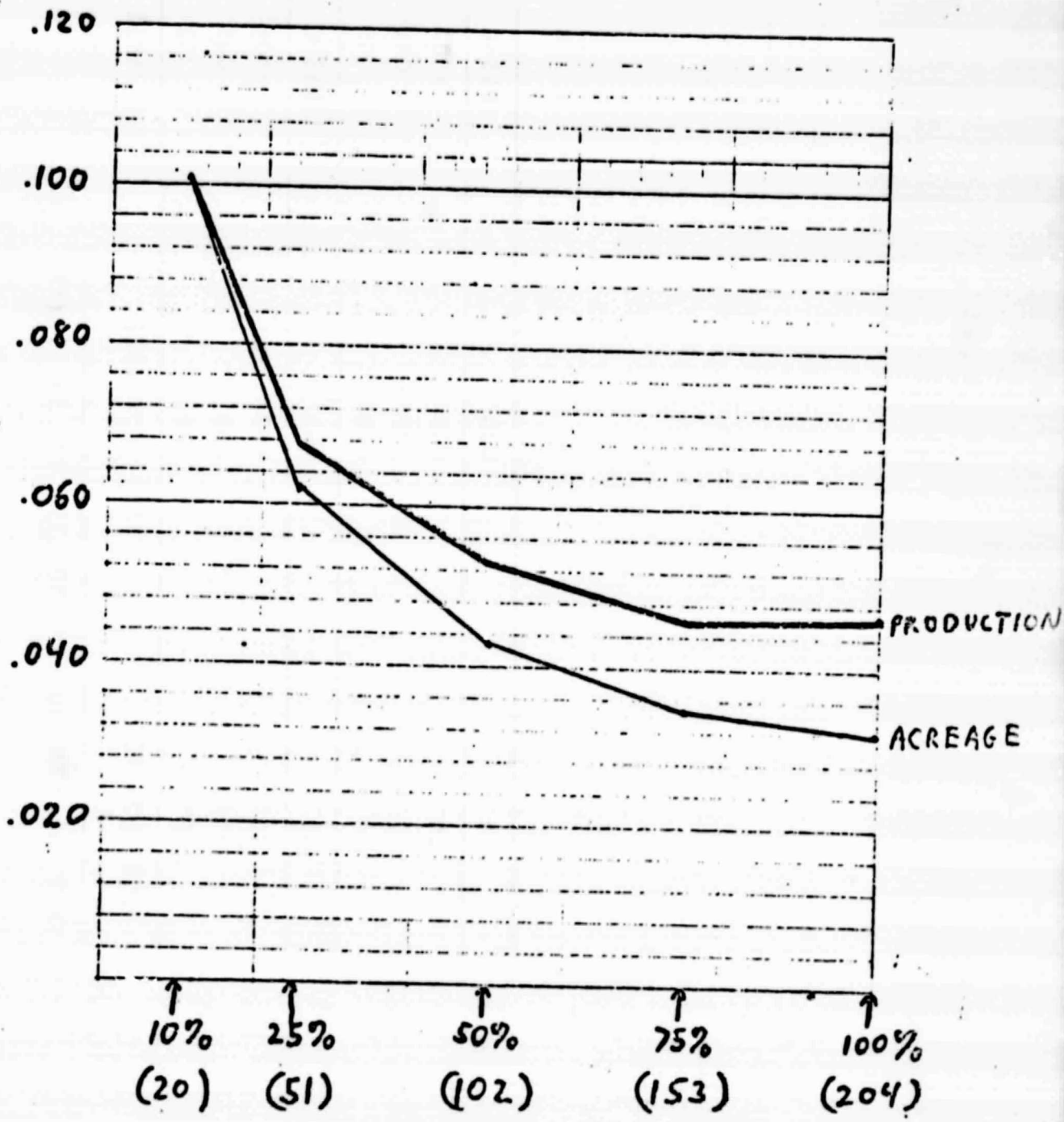
STATE	100% ACQ. RATE	10% ACQ. RATE
ILL	-.001	-.002
IND	.000	-.006
IOWA	.001	.009
3-STATE	.000	.002
ILL	.003	-.014
IND	-.007	-.009
IOWA	.000	-.023
3-STATE	.000	-.016

#5

CORN - 3 STATE TOTAL

1978 PRODUCTION = 3.4027×10^9 bu.

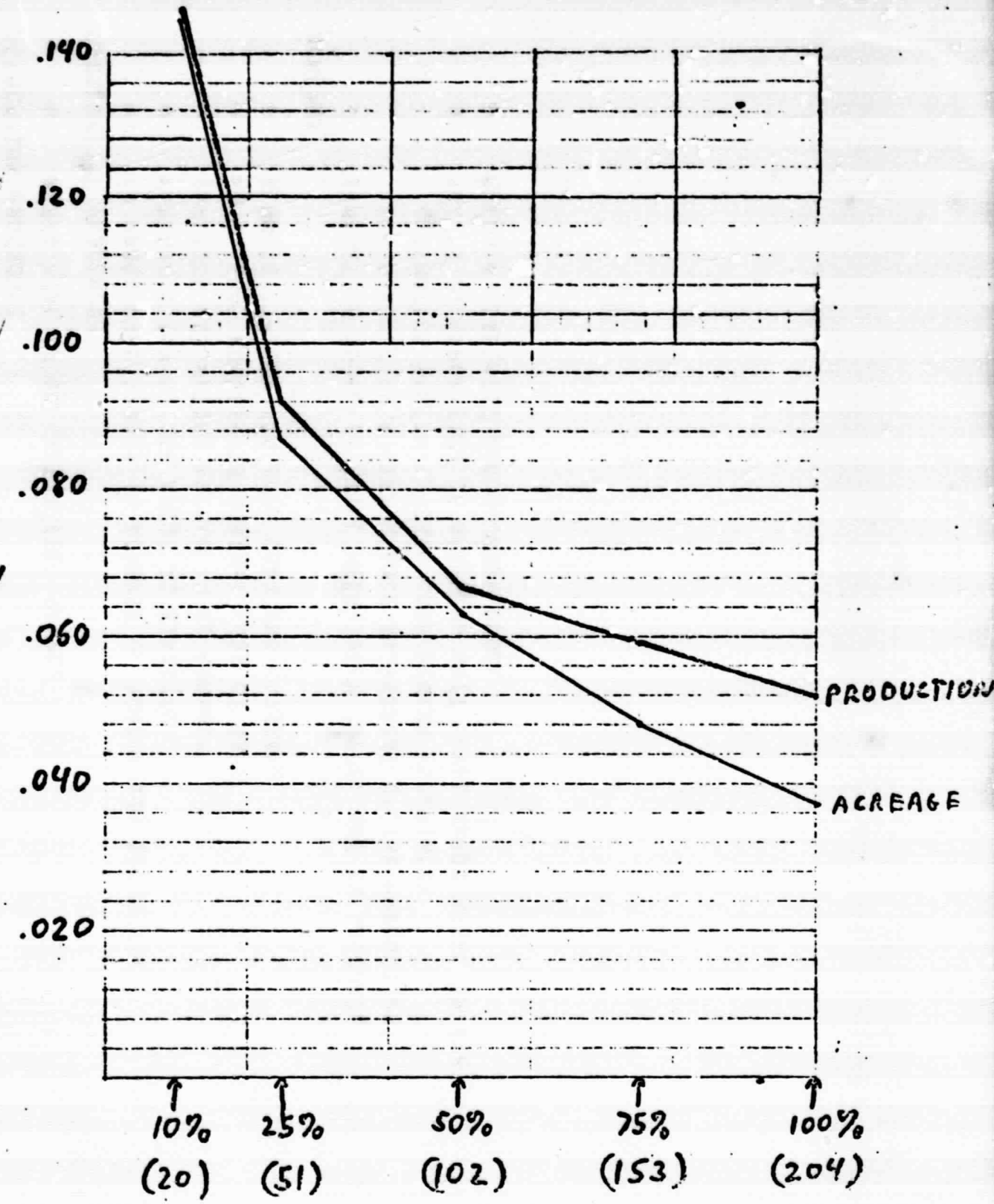
1978 ACREAGE = 3.0110×10^7 ac.



SOYBEANS 3-STATES

1978 PRODUCTION = 7.2997×10^8 bu.

1978 ACREAGE = 2.0828×10^7 ac.



#5

CONCLUSIONS

ALLOCATION PROCEDURE

- MEETS GOAL OF 5% CV FOR FULL SAMPLE

AGGREGATION PROCEDURE

- NO PROCEDURAL BIASES IN ACREAGE OR PRODUCTION ESTIMATES
- VARIANCES (CV'S) ARE ABOUT AS EXPECTED
- VARIANCE ESTIMATORS APPEAR TO BE CORRECT
- SHOWS GOOD ROBUSTNESS AGAINST LOSS OF DATA
- RESULTS SIMILAR FOR BOTH CORN AND SOYBEANS

REMARKS

- SIMULATION MODEL IS STILL RELATIVELY CRUDE, BUT IS ADEQUATE FOR CONDUCTING A PERFORMANCE ASSESSMENT OF THE PRODUCTION ESTIMATION SYSTEM IN EACH CROP/REGION EXPERIMENT
- AWAITS INCORPORATION OF SAMPLING UNIT LEVEL ERROR MODEL IN FY81
- NEEDS A REALISTIC CLOUD-COVER MODEL

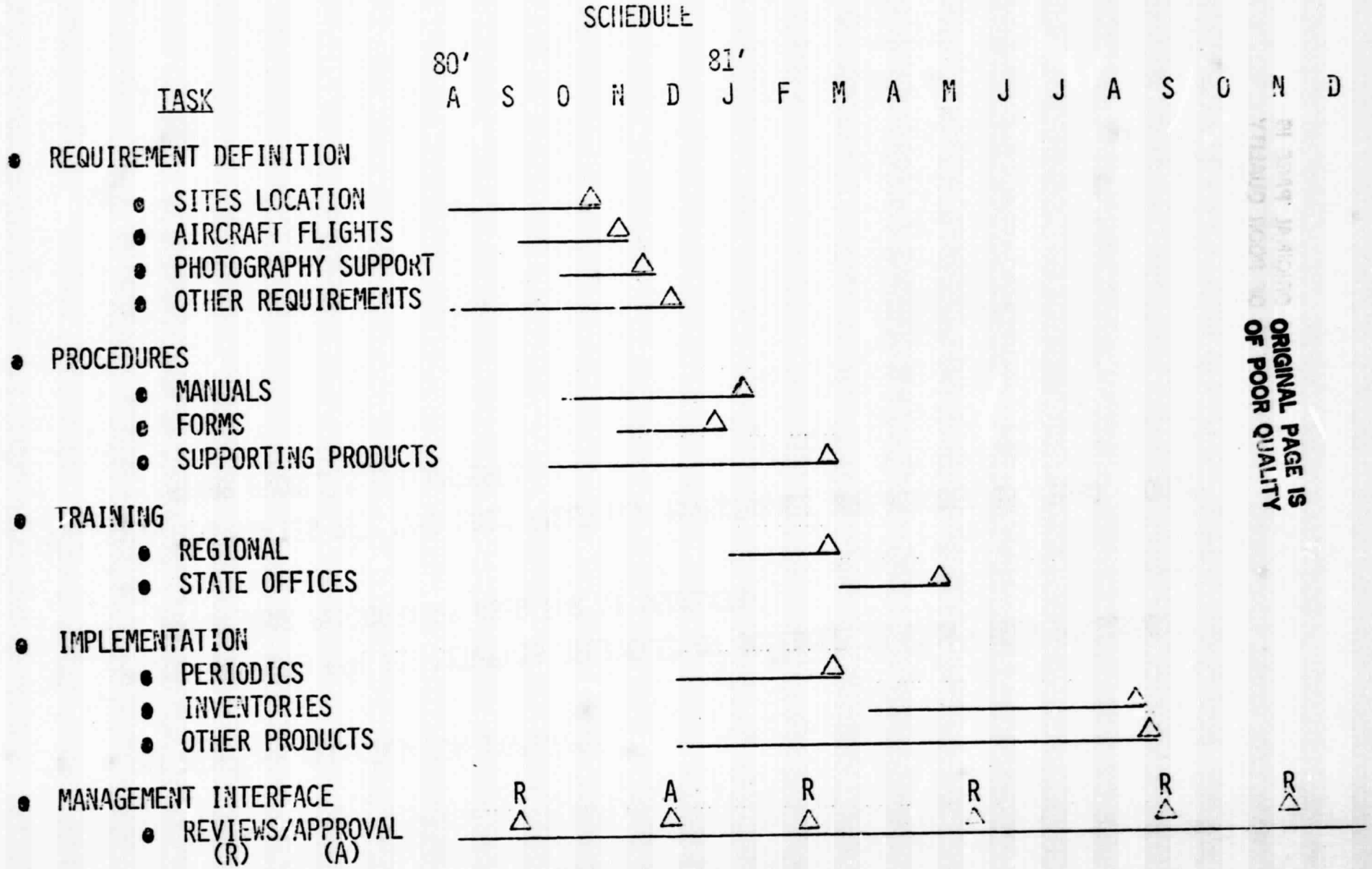
#5

1980 AIRCRAFT DATA

- 320 SEGMENTS SELECTED FOR INVENTORY
- PHOTO PRODUCTS FOR 299 SEGMENTS DELIVERED ON SCHEDULE TO USDA FIELD PERSONNEL. PRIOR YEAR PHOTOGRAPHY USED FOR 41 SEGMENTS
- 130 INVENTORIES RECEIVED FROM FIELD. ALL INVENTORIES DUE OCTOBER 15, 1980. ONLY MINOR PROBLEMS ENCOUNTERED

Attachment # 6

- 1981 PROGRAM SCOPED AT 320 SEGMENT LEVEL



#6

LANDSAT DATA PROCESSING

I - BACKGROUND

- FOR CROP YEAR 1980, PLANS WERE TO TERMINATE LACIE PROCESSOR (GSFC) SEGMENT EXTRACTION
  - CAPABILITY IMPLEMENTED AT JSC TO EXTRACT FROM HIGH DENSITY DIGITAL TAPES
  - JSC SYSTEM DEPENDENT UPON REGISTRATION OF MDP (± 1 PIXEL OR LESS)
- MDP COULD NOT ALWAYS DELIVER ± 1 PIXEL ACCURACY
  - SYSTEM CAN MEET SPEC. UNDER PROPER CONDITIONS
- AgRISTARS CLASSIFICATION TECHNOLOGY REQUIRES MULTI-TEMPORAL DATA REGISTERED TO MINIMUM ± 1 PIXEL; LESS IN SMALL FIELDS AREAS
- MDP OUTPUT COULD NOT CONSISTENTLY SUPPORT REGISTRATION

#6

BACKGROUND - CONT'D

- IN MARCH DECISION MADE TO BUILD LOCAL JSC REGISTRATION CAPABILITY
  - CURRENT IMPLEMENTATION SCHEDULE: MARCH 1, 1981

- DECISION MADE TO REQUEST REINSTATEMENT OF LACIE PROCESSOR SO 1981 MILESTONES FOR CORN/SOYBEANS AND WHEAT BARLEY PILOTS COULD BE MET
  - PROCESS 1980 CROP YEAR DATA
  - LATER YEARS WOULD BE PROCESSED ON JSC SYSTEM

- CONCURRENT WITH DISCOVERY OF REGISTRATION DIFFICULTIES, LANDSAT-3 EXHIBITED SIGNIFICANT DATA QUALITY PROBLEMS
- MOST CAN BE ATTRIBUTED TO LINE START ANOMALY ONBOARD LANDSAT-3 OR IN SUBSEQUENT GROUND FIXES

- MUCH OF DATA ACQUIRED FROM MARCH-PRESENT EXHIBITS QUALITY PROBLEMS

#6

II - CURRENT SITUATION

A - LACIE PROCESSOR REINSTATEMENT

- TECHNICAL PROBLEMS PLAGUED REINITIALIZATION OF LACIE PROCESSOR
  - LANDSAT-2 OPERATION PROCESSING COMMENCED SEPTEMBER 19, 1980
  - LANDSAT-3 PROBLEMS CURRENTLY UNDER INVESTIGATION
    - GSFC SENDING IPF TEAM TO JSC ON SEPTEMBER 23-24 TO GAIN ADDITIONAL INSIGHT INTO THE PROBLEMS

- PROBLEMS WITH BRINGING UP LACIE PROCESSOR HAVE DELAYED AVAILABILITY OF 1980 DATA SET FOR:
  - U.S. WHEAT/BARLEY PILOT (SCHEDULED- JANUARY 1981)
  - U.S. CORN SOYBEANS PILOT (SCHEDULED - JANUARY 1981)
- "REALISTIC" RECOVERY PLAN FOR LACIE PROCESSOR BEING DEVELOPED
  - ASSUMES THAT LANDSAT-3 FIX WILL BE INSTITUTED IN NEAR FUTURE

#6

CURRENT SITUATION

DATA QUALITY

- NOT ALL SR/FCPF CROP YEAR 1980 LANDSAT PROCESSED BY GSFC LACIE PROCESSOR
- SOME DATA SETS ARCHIVED IN HDT FORMAT FOR SUBSEQUENT EXTRACTION AND REGISTRATION AT JSC
- CONCERNS BEGAN TO ARISE REGARDING QUALITY OF FULL-SCENE DATA
- IN AUGUST DELEGATION TRAVELED FROM JSC TO EDC TO CONDUCT INVENTORY OF AREAS OF INTEREST
  - ARGENTINA
  - AUSTRALIA
  - U.S.
  - BRAZIL WINDOWS OPENED - AUGUST 1, 1980 AND DATA NOT AVAILABLE AT EDC TO REVIEW

#6

ARGENTINA -

EXPECTED/PREDICTED - 290 SCENES AT EDC - 136 SCENES OR 47%

- ACCEPTABLE AS IS: 48(19 > 90% CLOUD)
- POTENTIALLY SALVAGEABLE WITH GSFC REPROCESSING - 58 (23 > 90% CLOUD)
- UNRECOVERABLE: 30

AUSTRALIA -

EXPECTED/PREDICTED - 140 SCENES AT EDC - 58 SCENES OR 41%

- ACCEPTABLE AS IS: 40(3 > 90% CLOUD)
- POTENTIALLY SALVAGEABLE: 17(6 > 90% CLOUD)
- UNRECOVERABLE: 1

UNITED STATES -

EXPECTED/PREDICTED - 1104 SCENES AT EDC - 820 SCENES OR 75%

- ACCEPTABLE AS IS: 381
- POTENTIALLY SALVAGEABLE: 358
- UNRECOVERABLE: 81

820 REVIEWED
345 L/S-2
4/5 L/S-3

CONCERNS

- INVENTORY AT EDC SHOWED THAT FOR AUSTRALIA AND ARGENTINA ONLY 50% OF EXPECTED DATA WAS AT EDC
  - RESULTED IN POOR TEMPORAL COVERAGE OVER A SIZABLE NUMBER OF SITES
  - REMAINDER IN GSFC BACKLOG, APPARENTLY NOT EASILY PROCESSABLE
  - CHANCES FOR SUCCESSFUL REPROCESSING OF MISSING DATA CURRENTLY UNKNOWN
- U.S. BETTER - YIELDED APPROXIMATELY 75% EXPECTED DATA

#6

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENTS
U.S. W/B PILOT	° LANDSAT:			
	U.S. 77 SEGMENTS 1980	1/1/81	11/15/80	GSFC 18 DAY
			6/1/81	GSFC 9 DAY
	U.S./CANADA 209 SEGMENTS 75-79	1/1/81	12/1/80	REFILM 360 Acq.
	° GROUND OBSERVATIONS			
	U.S. 77 SEGMENTS 1980	7/15/81/	7/15/81	
	U.S. 209 SEGMENTS 75-79	7/15/81	COMPLETE	
	CANADA 1978-79 (60 SEGMENTS)	7/15/81	3/1/81	
	° METEROLOGICAL DATA			
	HISTORICAL DATA ONLY (75-79)	1/1/81	1/1/81	
	° CROP CALENDARS			
	HISTORICAL (NOMINAL)	12/1/80	12/1/80	
	° AGRONOMIC			
	HISTORICAL CROP STATISTICS	12/1/80	12/1/80	
	° MAPS	12/1/80	12/1/80	

TO EXTENT POSSIBLE, REQUESTED DATES EXTRACTED FROM UPDATED PIP

#6

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENTS
U.S.S.R. BARLEY E.E.	° LANDSAT			
	FOREIGN - 25 SEGMENTS 76-78	11/1/80	COMPLETE	
	FSR:			
	25 SEGMENTS 76-80	11/1/80	11/15/80	AT GSFC (16 DAY COVERAGE)
	25 SEGMENTS 78-80	11/1/80	6/01/81	AT GSFC (8 DAY COVERAGE)
	° GROUND OBSERVATIONS			
	FSR:			
	25 SEGMENTS, 1980	6/1/81	6/01/81	
	25 SEGMENTS 76-79	6/1/81	COMPLETE	
	° METEROLOGICAL DATA	6/1/81	7/01/81	
	° CROP CALENDARS			
	HISTORICAL	5/1/81	5/01/81	
	ADJUSTED	5/1/81	5/01/81	
	° AGRONOMIC	TBD	TBD	
	° MAPS	TBD	TBD	

* TO EXTENT POSSIBLE, REQUESTED DATES EXTRACTED FROM UPDATED PIP

#6

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENTS
U.S.S.R. BARLEY PILOT	° LANDSAT			
	FOREIGN-50 SEGMENTS 76-78	8/1/81	COMPLETE	
	FSR:			
	50 SEGMENTS 76-80	8/1/81	11/15/80	AT GSFC (18 DAY COVERAGE)
	50 SEGMENTS 78-80	8/1/81	6/1/81	AT GSFC (9 DAY COVERAGE)
	° GROUND OBSERVATIONS			
	FSR:			
	50 SEGMENTS 1980	2/15/82	6/1/81	
	50 SEGMENTS 76-79	2/15/82	COMPLETE	
	° METEROLOGICAL DATA	6/1/81	6/1/81	
	° CROP CALENDARS			
	HISTORICAL	6/15/81	6/15/81	
	ADJUSTED			
	° AGRONOMIC	TBD	TBD	
	° MAPS	TBD	TBD	

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* TO EXTENT POSSIBLE, REQUESTED DATES EXTRACTED FROM UPDATED PIP

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENTS
1981 U.S. C/S PILOT	° LANDSAT - 1978-1980 200 SEGMENTS	2/15/81	3/15/81	
	° GROUND DATA-1978-1980			
	110 SEGMENTS IN 1980	___	9/1/81	AT HARVEST WALL-TO-WALL ONLY
	1979	___	COMPLETE	
	1978		COMPLETE	
	° METEOROLOGICAL DAILY CLIMOGRAPHS	2/15/81	2/15/81	
	° CROP CALENDARS			
	NORMAL	1/1/81	1/1/81	
	ADJUSTED	2/1/81	2/1/81	
	° AGRONOMIC			
	HISTORICAL CROP STATS.	___	2/15/81	
	° MAPS	___	COMPLETE	

* TO EXTENT POSSIBLE, REQUESTED DATES EXTRACTED FROM UPDATES PIP

#6

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENT
G. WHEAT E.E.	° LANDSAT:			
	FOREIGN-50 SEGMENTS, 1980	___	7/1/81	AT JSC
	FSR _ 25 SEGMENTS, 75-80	___	5/1/81	PROCESSING AT GSFC (18 DAY COVERAGE)
			6/1/81	1980 PROCESSING AT GSFC (9 DAY COVERAGE)
	° GROUND OBSERVATIONS			
	FSR - 25 SEGMENTS, 1980	4/1/83	5/1/82	
	75-78	4/1/83	COMPLETE	
	1979	4/1/83	11/1/83	
	° METEROLOGICAL DATA			
	HISTORICAL, CURRENT YEAR	1/1/83	1/1/83	
	° CROP CALENDARS			
	HISTORICAL	1/1/83	1/1/83	
	ADJUSTED	1/1/83	1/1/83	
	° AGRONOMIC	TBD	TBD	
	° MAPS	___	?	

* TO EXTENT POSSIBLE, REQUESTED DATES EXTRACTED FROM UPDATED PIP

#6

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENTS
936 BRAZIL C/S E.E.	° LANDSAT			
	FOREIGN-36 SEGMENTS 1980	—	8/1/81	AT JSC
	FSR-50 SEGMENTS 78-80	—	5/1/81	AT GSFC(18 DAY COVERAGE)
			6/1/81	AT GSFC (9 DAY COVERAGE)
	° GROUND OBSERVATIONS -			
	FOREIGN - 5 SITES, 1980	—	—	
	FSR - 50 SEGMENTS, 1980	12/1/82	12/1/82	
	1979	—	11/1/80	
	1978	—	COMPLETE	
	° METEOROLOGICAL			
	HISTORICAL, CURRENT YEAR	2/1/82	2/1/82	
	° CROP CALENDARS			
	HISTORICAL	3/1/82	3/1/82	
	ADJUSTED	3/1/82	3/1/82	
	° AGRONOMIC	TBD	TBD	
	° MAPS	TBD	TBD	

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* TO EXTENT POSSIBLE REQUESTED DATES EXTRACTED FROM UPDATED PIP

#6

EXPERIMENT	DATA SET	REQUESTED DELIVERY*	PLANNED DELIVERY	COMMENTS
RG. C/S E.E.	° LANDSAT			
	FOREIGN-50 SEGMENTS 1980	10/1/81	7/1/81	AT JSC
	FSR: 25 SEGMENTS 78-80	10/1/81	5/1/81	AT GSFC (18 DAY COVERAGE)
			6/1/81	AT GSFC (9 DAY C COVERAGE)
	° GROUND OBSERVATIONS			
	FSR: - 25 SEGMENTS, 1980	5/1/82	5/1/82	
	- 25 SEGMENTS, 1978		COMPLETE	
	- 25 SEGMENTS, 1979		11/1/80	
	° METEROLOGICAL			
	HISTORICAL AND 80 CROP YEAR	1/1/82	1/1/82	
	° CROP CALENDARS			
	HISTORICAL	1/1/82	1/1/82	
	ADJUSTED	1/1/82	1/1/82	
	° AGRONOMIC	TBD	TBD	
	° MAPS	TBD	TBD	

* TO EXTENT POSSIBLE, REQUESTED DATES EXTRACTED FROM UPDATED PIP

FCPF

SEMI-ANNUAL

PROJECT REVIEW

9/24/80

SUPPORTING

AGRICULTURAL

DATA

ATTACHMENT # 7

- SUPPORTING DOMESTIC AGRICULTURAL DATA
  - GROUND DATA COLLECTION
    - PERIODIC SITES
      - 209 IN WORK, PERIODIC DATA BEING PUNCHED IN STATE OFFICES AND THEN LOADED TO TAPE AT JSC VIA THE MMDS.
    - INVENTORY SITES
      - 299 IN WORK, 258 USING CURRENT YEAR PHOTOGRAPHY, 41 WITH PRIOR YEAR PHOTOGRAPHY, 135 COMPLETED TO DATE, REMAINING SCHEDULED TO BE COMPLETED BY OCT 15.
    - ROBESON COUNTY, N.C.
      - GROUND DATA COLLECTION COMPLETED JULY 21, USING 1980 AIRCRAFT COVERAGE, SEGMENT DIGITIZATION CURRENTLY UNDERWAY.
    - DOMESTIC CROPS/LAND COVER
      - CIR PHOTOGRAPHY ACQUIRED FOR ALL 86 SITES, DATA COLLECTION COMPLETE, DIGITIZATION BEGINS SEPT 15.

- o DOMESTIC AGRICULTURAL DATA
  - o HISTORIC CROP DEVELOPMENT STAGES, 75-79
    - o IOWA, ILL, IND, MINN, MO, OHIO, RECEIVED SEPT 15.
    - o REMAINING STATES DUE OCT 15.
    - o ILL, IND, IOWA, N.D. WILL SUBMIT SAME DATA SET FOR THE 1980 CROP SEASON ON FEB 16, 1981.
  - o HISTORIC COUNTY ESTIMATES
    - o RECEIVED REVISED DATA TAPE OF COUNTY ESTIMATES FROM 1972-79, RELEASED TO SF4, TO BE LOADED ONTO THE LARS SYSTEM.
  - o HISTORIC CROPS ESTIMATE DATA BASE
    - o STATE AND U.S. HISTORIC ESTIMATES FROM 1954-1979 FOR ALL FIELD CROPS RECEIVED AT JSC, AVAILABLE UPON REQUEST.
  - o U.S., STATE AND COUNTY MAPS
    - o FIPS CODE STANDARDS FOR U.S. COUNTY CROP REPORTING DISTRICTS AND STATE: PRINTED AND DISTRIBUTED TO TASK LEADERS.

GROUND DATA STATUS
SEPTEMBER 23, 1980

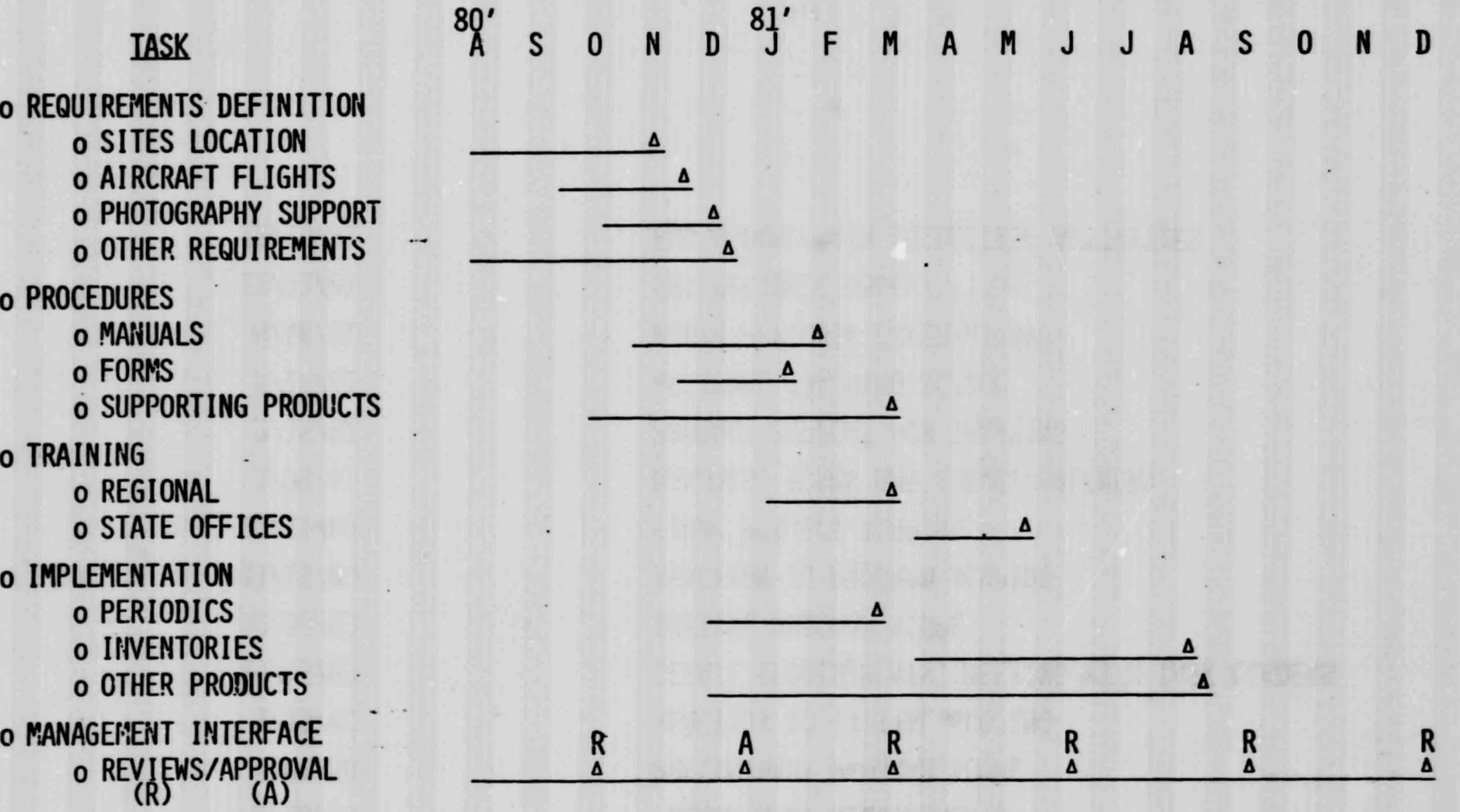
STATE	NUMBER OF SITES	PERIODICS IN WORK	INVENTORIES IN WORK 1980	INVENTORIES IN WORK PRIOR YEAR	INVENTORIES RETURNED
ALABAMA	5	5	5		--
ARKANSAS	9	9	9		--
CALIFORNIA	4	4	4		4
COLORADO	1	1	1		1
DELAWARE	2	2	0	2	--
GEORGIA	7	7	7		6
ILLINOIS	50	6	46		17
INDIANA	35	9	31	1	32
IOWA	50	9	36	2	26
KANSAS	5	5	5		5
KENTUCKY	4	4	4		1
LOUISIANA	9	9	9		9
MARYLAND	2	2	0	2	1
MINNESOTA	12	12	5	6	--
MISSISSIPPI	10	10	10		--
MISSOURI	4	4	4		--
MONTANA	16	16	16	10	1
NEBRASKA	5	5	5		2
NORTH CAROLINA	5	5	5		2
NORTH DAKOTA	35	35	26	9	10
OHIO	5	5	5		5
OREGON	3	3	3		1
PENNSYLVANIA	4	4	0	4	--
SOUTH CAROLINA	4	4	3	1	--
SOUTH DAKOTA	16	16	12	3	--
TENNESSEE	1	1	1		--
TEXAS	17	17	16	1	12
TOTALS	320*	209	258	41	135
ROBESON	(35 CIR FRAMES) (210 B/W FRAMES)		35		35
KANSAS	86		86		86

* 21 DROPPED

#7

- o FOREIGN AGRICULTURAL DATA SUPPORT
  - o SAMPLE FRAME DEVELOPMENT
    - o SUPPORTING DATA PRODUCTS FROM CCAD/FAS REQUESTED.
      - o CIR FULL FRAMES OVER INDICATOR REGION IN HOUSE.
      - o REQUESTED DR. WESTIN AG/NON-AG MAPS, EXPECTED DELIVERY OCT 1.
  - o FOREIGN TRAVEL
    - o ESCS APPROVAL FOR TRAVEL OF MR. BILL DOWDY TO AUSTRALIA.
  - o CANADIAN GROUND DATA
    - o 1979 GROUND DATA INVENTORIES RECEIVED APRIL 28.

1981 GROUND DATA
MILESTONE CALENDAR



#7

1981 GROUND DATA SURVEY
MILESTONE CALENDAR

DATE	EVENT
8/18/80	PRELIMINARY REQUIREMENTS
9/01/80	PRELIMINARY PROGRAM SCOPE
9/15/80	REACTION TO INITIAL SCOPING
10/15/80	DETAIL REQUIREMENTS, MEETING WITH TASK LEADERS
10/30/80	INITIAL PROGRAM SCOPE
11/15/80	REACTION TO PROGRAM SCOPING
12/11/80	FINAL PROJECT SCOPING
1/09/81	MANUALS, FORMS AND SURVEY CALENDAR
2/15/81	PRODUCT SUPPORT FOR TRAINING
3/18/81	REGIONAL TRAINING SCHOOL
4/16/81	BEGIN PERIODIC OBSERVATIONS
11/01/81	END PERIODIC OBSERVATIONS
12/20/81	END GROUND DATA COLLECTION ACTIVITIES

#7

SEMI-ANNUAL FCPF PROJECT REVIEW
FOREIGN AGRICULTURAL DATA

- SUPPORTING AGRONOMIC DATA TASKS FOR AUSTRALIA WHEAT, USSR WHEAT/BARLEY, BRAZIL CORN/SOYBEANS, ARGENTINA WHEAT/CORN/SOYBEANS HAVE NOT BEEN INITIATED BY USDA
- A FOREIGN AGRICULTURAL DATA (FAD) TEAM WAS ESTABLISHED 2/80
- PURPOSE: DEVELOP PLANS FOR AND TO CARRY OUT TASKS FOR ACQUISITION OF FOREIGN AGRICULTURAL DATA FOR FCPF AND SR SUPPORT TO FCPF
- TEAM HAS DEVELOPED A LIST OF AGRICULTURAL DATA REQUIREMENTS FOR EACH COUNTRY (USSR, AUSTRALIA, ARGENTINA, BRAZIL, INDIA)
- AN IN-HOUSE AGRICULTURAL DATA INVENTORY HAS BEEN CONDUCTED
  - SF6 IS COORDINATING DEVELOPMENT OF DATA MANAGEMENT PLANS WITH THE FAD TEAM
- FCPF FOREIGN AGRICULTURAL DATA PLAN IS IN PREPARATION
- INTERNATIONAL COOPERATIVE RESEARCH AGREEMENTS
  - BRAZIL - DRAFT PLAN COMPLETED 9/3/80; SENT TO BRAZIL BY HQ
  - ARGENTINA - DRAFT PLAN IN PREPARATION
  - AUSTRALIA - DRAFT PLAN IN PREPARATION

ATTACHMENT # 8

METEOROLOGICAL DATA STATUS

Country	Experiment	Needs (Yrs)	Available	Tentative Additions	DD FY	Not Available	Caveats
USSR	W/B	1976-78	Most of 2195 Soviet Stas included in QA/QC data sets. Avail 9-77-current	1976 and 77 WMO data needs procurement and reformatting. Much data prob avail in-country.	81	UnKnown	Extremely good-best quality and net in WMO.
Argentina	C/S W/B	1975-80	9-77-current; 91 usable WMO stas	Ag-met, coop, and historical data prob avail in-country	81	UnKnown	Continuity and quality variable
Australia	W/B	1975-80	9-77-current; 62 usable WMO stas	Ag-met, historical, & Coop data prob avail in-country.	81	UnKnown	Network density, continuity, quality very poor.
Brasil	C/S	1974-80	9-77-current; 133 WMO stas.	Ag-met & Coop data prob avail in-country.	82	UnKnown	Continuity and quality variable.

ATTACHMENT # 9

METEOROLOGICAL DATA STATUS

Country	Experiment	Needs (Yrs)	Available	Tentative Additions	DD FY	Not Available	Caveats
U.S.A.	W/B S/C FSR	1977-80 1978-80 1975-80	9-77-current. Scattered data sets and paper products.	Reformat 1966-75. Coop data 1878-1978. Coop data 1979 & on.	80	All is Available	Problems are reducing paper records to tape and software.
Canada	W/B FSR	1977-80 1975-80	9-77-current; all WMO stas	Manitoba & Saskatchewan 1975-79 by 10-1-80.	80	All is Available	None. Data excellent

#9

METEOROLOGICAL DATA STATUS

Country	Experiment	Needs (Yrs)	Available	Tentative Additions	Not Available	Caveats
China	Unknown	Mid-1980's	1977-current	None Planned other than current conduits. Ag-met data avail in-country, or in U. K. - Desirable.	All is available	None. Excellent data.
India	Unknown	Mid-1980's	1977-current	As per China	All is available	None. Good data.
Mexico	UnKnown	Mid-1980's	1977-current	Coop and historical data highly desired.	Unknown	Quality suspect.

#9

AgRISTARS FCPF PROJECT REVIEW

9-24-80

ACCURACY ASSESSMENT METHODOLOGY DEVELOPMENT

+ TASK OBJECTIVE
  -- DEVELOP TECHNIQUES FOR ASSESSING AREA AND PRODUCTION ESTIMATION ACCURACY WITH EMPHASIS ON FOREIGN SITUATIONS WITH LIMITED GROUND DATA

+ APPROACH
  -- DEVELOP PROCEDURES FOR EVALUATING SEGMENT-LEVEL LABELING AND PROPORTION ESTIMATION ACCURACIES IN FOREIGN AREAS
  -- DEVELOP METHODOLOGY FOR DEVELOPMENT OF AN ERROR MODEL FOR SIMULATING AND EVALUATING LARGE AREA ACREAGE AND PRODUCTION ESTIMATION ERROR COMPONENTS

ATTACHMENT # 10

STATUS

-- INITIAL PROCEDURE (MAXIMAL ANALYSIS) WAS DEVELOPED BASED ON INTENSIVE ANALYST AND MACHINE ANALYSES OF SELECTED SEGMENTS (SATISFY CERTAIN CRITERIA)

-- INITIAL RESULTS INDICATED MAXIMAL ANALYSIS DID NOT PRODUCE HIGHER ACCURACIES THAN STANDARD PROCEDURES

-- AN EXPERIMENT DESIGN FOR FURTHER TESTING THIS PROCEDURE WAS DEVELOPED AND PRESENTED TO THE JOINT TECHNICAL COORDINATION TEAM (6/23/80)

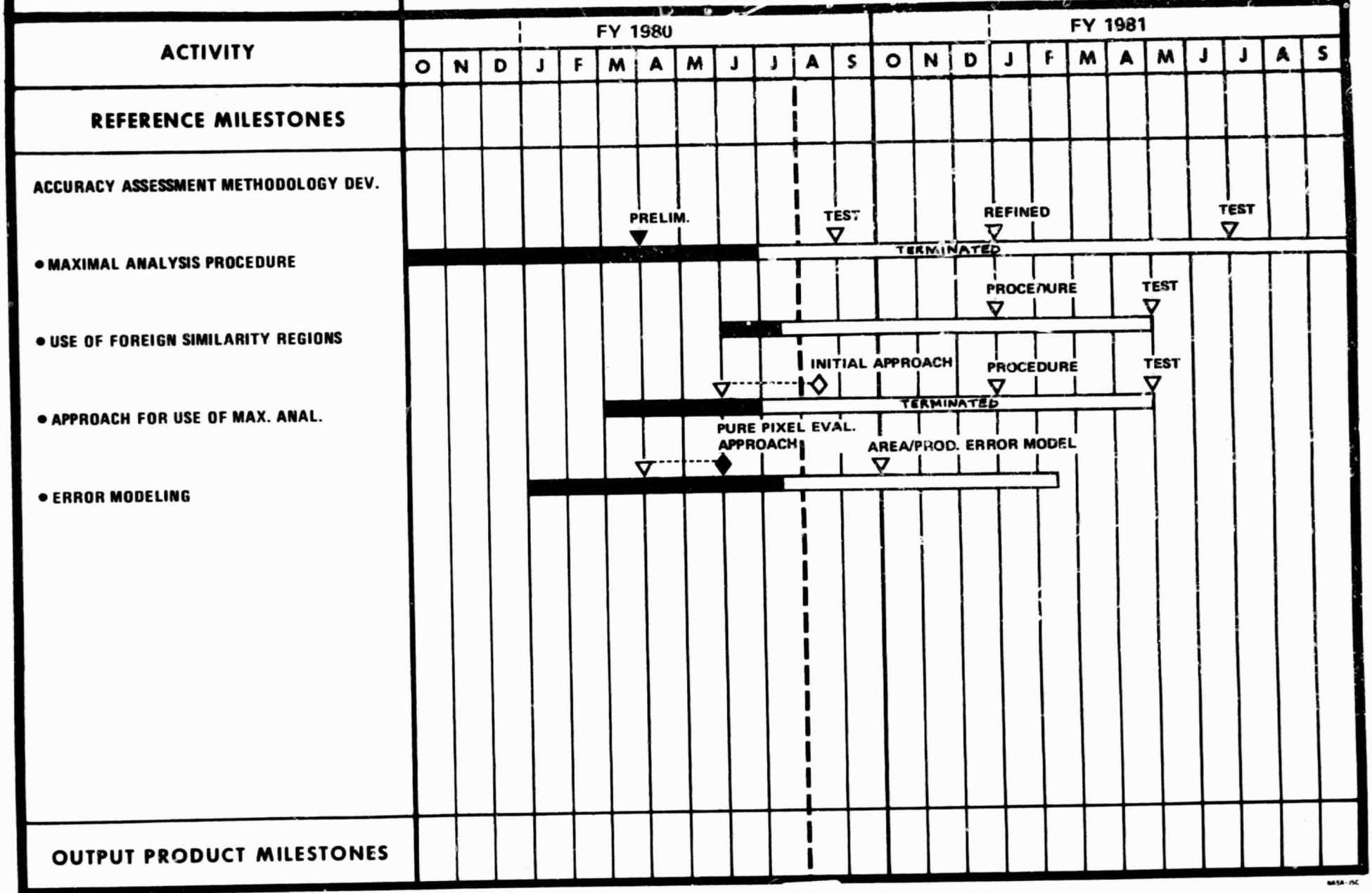
  - CONCLUDED AT THAT TIME THAT ORIGINAL CONCEPT OF MAXIMAL ANALYSIS WAS NOT VIABLE FOR RELATING LABELING ACCURACY TO ANALYST CONSISTENCY (USING OBJECTIVE LABELING PROCEDURE VERY LITTLE ANALYST-TO-ANALYST VARIABILITY IS EXPECTED)
  - RECOMMENDED THAT MAXIMAL ANALYSIS CONCEPT MAY BE APPROPRIATE WHEN SEVERAL DIFFERENT OBJECTIVE LABELING APPROACHES ARE AVAILABLE
  - RECOMMENDED THAT PROPOSED TEST NOT BE CONDUCTED

-- MODELING ACTIVITY HAS BEEN INITIATED

- INDIRECT APPROACH FOR EVALUATING SEGMENT LEVEL PERFORMANCE
- ATTEMPTING TO PREDICT PERFORMANCE BASED ON SEGMENT LEVEL PARAMETERS (E.G., SPRING SMALL GRAIN OMISSION/COMMISSION ERROR RATES AS FUNCTION OF PERCENT BOUNDARIES, MOISTURE STRESS, CROP CALENDAR VARIABILITY, ETC.)
- INITIAL DEVELOPMENT BASED ON P1 RESULTS FOR 1978 CROP YEAR

#10

REPORTING ORG./ACTIVITY:	06 – FCPF ACCURACY ASSESSMENT	DATE	8/1/80
		PAGE	1 OF 2



JSC Form 543 (OT) Jan. '80

MULTICROP
SAMPLING AND AGGREGATION
TECHNOLOGY DEVELOPMENT

PRESENTATION OUTLINE

- BACKGROUND
- OBJECTIVES
- FY80-85 - GENERAL TECHNICAL FOCUS
- FY81-82 - SPECIFIC TECHNICAL EMPHASIS
- RESULTS/STATUS
- ISSUES

ATTACHMENT #11

MULTICROP SAMPLING AND AGGREGATION TECHNOLOGY DEVELOPMENT

BACKGROUND

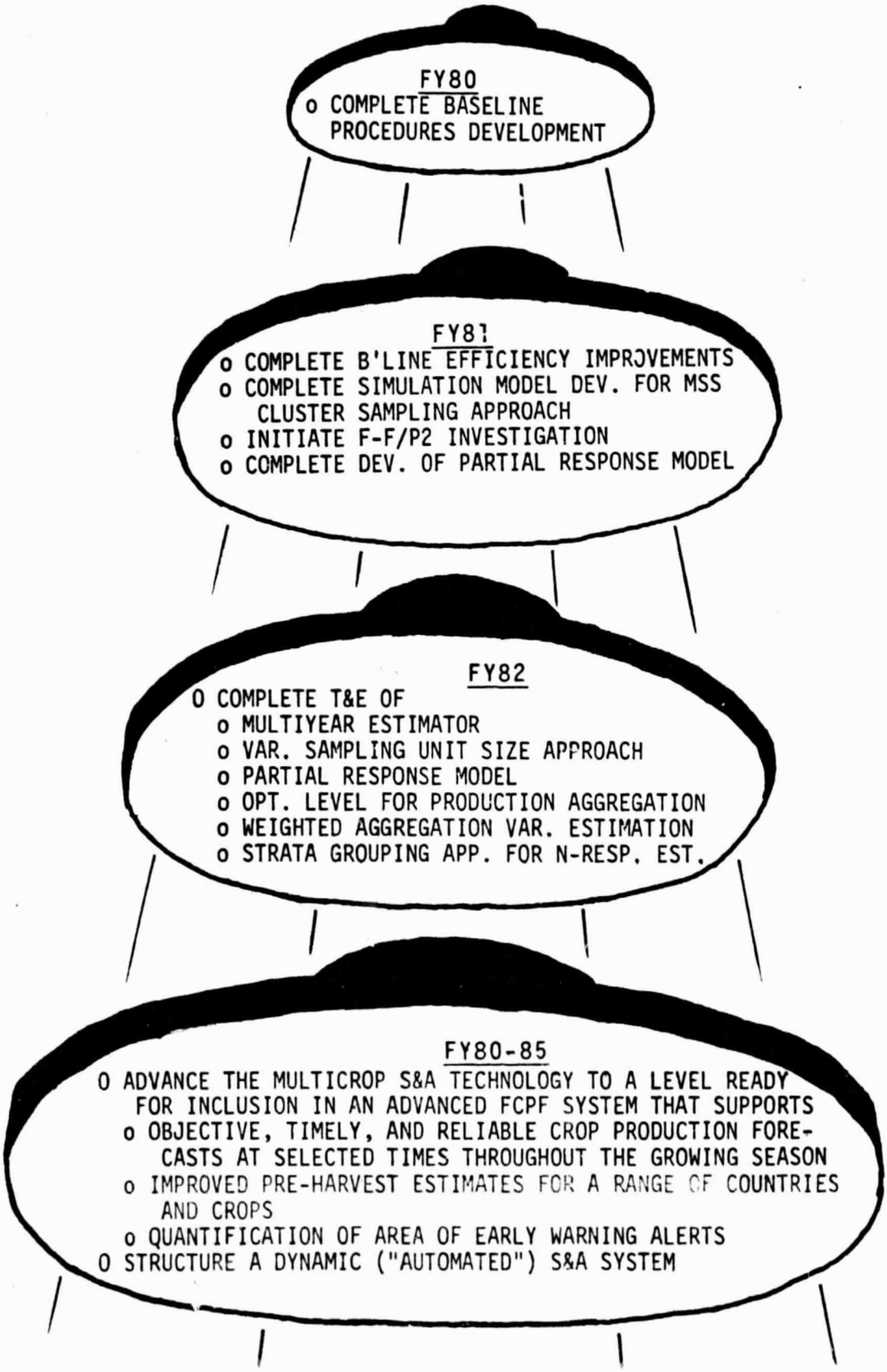
- STATUS AT END OF TY
  - ALLOCATION APPROACH
    - VALID FOR A SINGLE CROP ONLY
    - WITHIN-STRATUM VARIANCE ESTIMATOR INADEQUATE IN FOREIGN AREAS HAVING LITTLE TO NO PREVIOUSLY ANALYZED LANDSAT DATA
  - AGGREGATION APPROACH
    - INSTABILITY OF NONRESPONSE AREA ESTIMATOR CONTINUED AS A PRIMARY WEAKNESS
    - DEPENDENCE ON AN "IN" OR "OUT" SEGMENT WEIGHTING SCHEME FREQUENTLY WEAKENED THE INITIAL SAMPLE'S INFORMATION CONTENT
    - THE APPROACH UTILIZED LANDSAT DATA FROM THE CURRENT YEAR ONLY - IGNORED LANDSAT INFORMATION FROM PREVIOUS YEAR(s)
    - THE AGGREGATION APPROACH DID NOT SUPPORT AT-HARVEST ESTIMATES THROUGHOUT THE GROWING SEASON
  - SAMPLING AND AGGREGATION PROCEDURES HAD BEEN DEVELOPED, TESTED, AND EXERCISED FOR WHEAT ONLY

MULTICROP

SAMPLING AND AGGREGATION

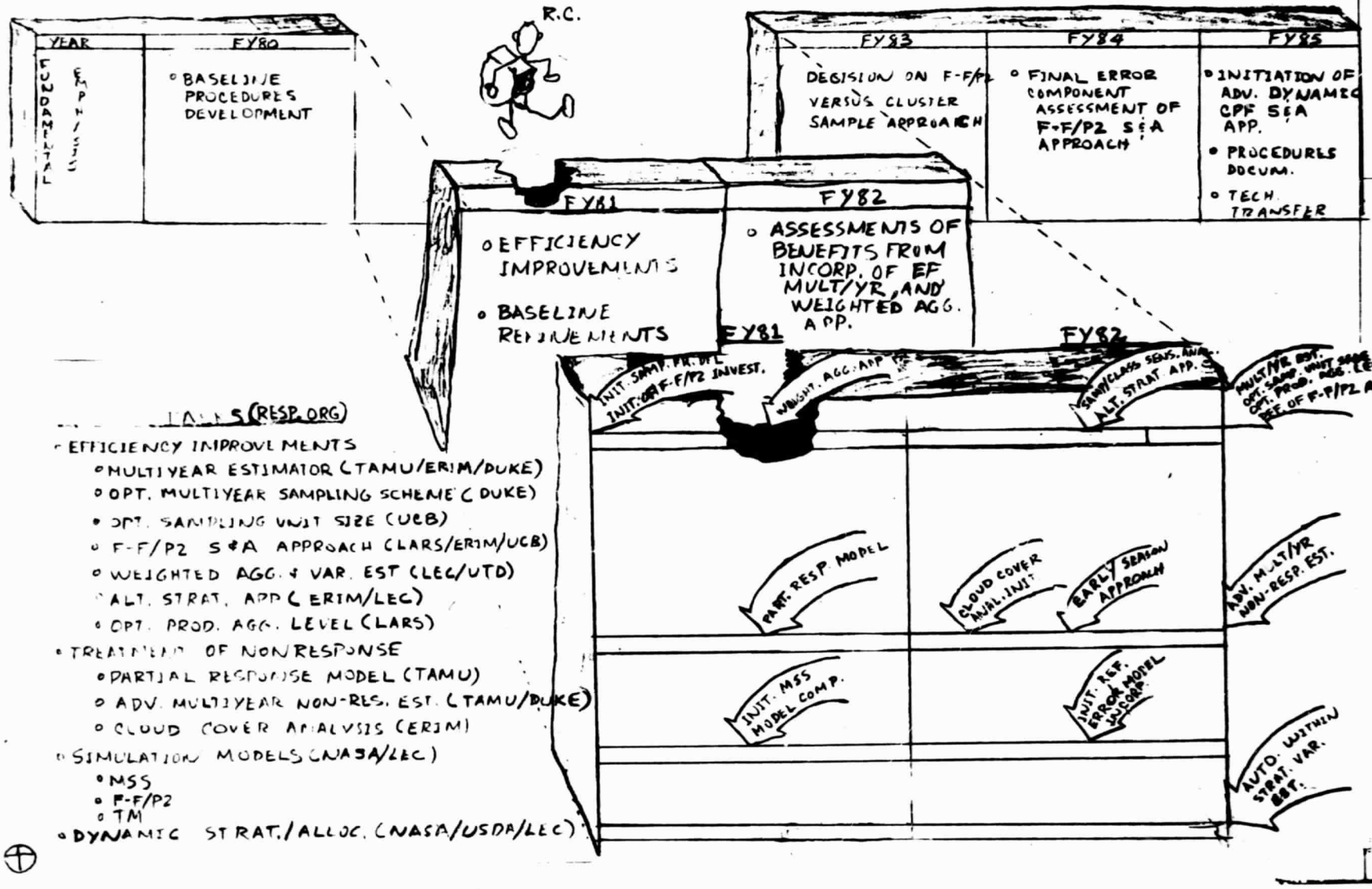
TECHNOLOGY DEVELOPMENT

FYO'S



MULTICROP

SAMPLING AND AGGREGATION TECHNOLOGY DEVELOPMENT FOCUS



- ... IALS (RESP. ORG)
  - EFFICIENCY IMPROVEMENTS
    - MULTIYEAR ESTIMATOR (TAMU/ERIM/DUKE)
    - OPT. MULTIYEAR SAMPLING SCHEME (DUKE)
    - OPT. SAMPLING UNIT SIZE (UCB)
    - F-F/P2 S&A APPROACH (LARS/ERIM/UCB)
    - WEIGHTED AGG. & VAR. EST (LEC/UTD)
    - ALT. STRAT. APP (ERIM/LEC)
    - OPT. PROD. AGG. LEVEL (LARS)
  - TREATMENT OF NONRESPONSE
    - PARTIAL RESPONSE MODEL (TAMU)
    - ADV. MULTIYEAR NON-RES. EST. (TAMU/DUKE)
    - CLOUD COVER ANALYSIS (ERIM)
  - SIMULATION MODELS (NASA/LEC)
    - MSS
    - F-F/P2
    - TM
  - DYNAMIC STRAT./ALLOC. (NASA/USDA/LEC)

MULTICROP SAMPLING AND AGGREGATION TECHNOLOGY DEVELOPMENT

RESULTS/STATUS SUMMARY

CATEGORY	PRE-AgRISTARS	CURRENT RESULTS
● EFFICIENCY IMPROVE.		
◆ MULTIYEAR EST DEV	◆ UTILIZED CURRENT YEAR SENSOR DATA ONLY.	o DEVELOPMENT OF OPTIMAL MULTIYEAR SAMP. SCHEME COMP. - DUKE o BASELINE ESTIMATOR DEV. IN PROGRESS; COMPLETION EXPECT. NOV. 1980 - TAMU/DUKE/LEMSCO o IMPLEMENTATION QA, AND NONRESP. SENSITIVITY ANALYSIS IN PROGRESS - ERIM
◆ OPTIMAL SAMP. UNIT	◆ UTILIZED 5x6 N.MI. SEG. (HIGHLY SUSPECT TO NOT BE OPTIMAL FOR ALL CROP/ REGIONS)	o A COST AND PERFORMANCE ANALYSIS PERFORMED ON SAMPLING UNIT SIZES OF 1.2, 2.6, 8.4, and 30 SQ. N.MI. USING P1-TYPE CLASS. APP.
◆ OPTIMAL PROD. AGG. LEVEL	◆ ELEMENTAL LEVEL OF COMBINING AREA AND YIELD WAS PRIMARILY STATE LEVEL	◆ VARIOUS LOWER LEVELS ARE BEING INVESTIGATED - INVEST. CURRENTLY LIMITED TO IOWA FOR CORN AND SOYBEANS - INITIAL RESULTS EXPECTED NOV. 1980 - (LARS)
◆ WEIGHTED AGG. & VAR. ESTIMATION	◆ AGGREGATION APPROACH USED "IN" OR "OUT" WEIGHTS	◆ BASELINE PROCEDURE DEVELOPED FOR ACREAGE AND PRODUCTION ESTIMATE
◆ P1-P/P2 S&A APP	◆ S&A SCHEME ORIENTED TOWARD "LARGE (1.e., 5x6)" CLUSTER SAMPLING SCHEME	◆ INITIAL DEF. BY NOV. 1980 OF PRELIMINARY APPROACHES FOR INVEST.
◆ ALTERNATIVE STRAT. APPROACHES	◆ MANUAL CONSTRUCTION OF NATURAL STRATA ◆ NOT EASILY MODIFIED ◆ OBJECTIVITY NOT WELL UNDERSTOOD	◆ INITIAL R&D SAMPLE FRAME DATA BASE TO BE DELIVERED JAN. 1981, FROM USDA/ESCS
● SIMULATION MODELING	o CHECKOUT OF S&A APPROACHES LIMITED PRIMARILY TO ACTUAL (1.e., NONSIMULATED) DATA SETS	o MODEL DEVELOPED THAT IS ADEQUATE FOR CONDUCTING A PERFORMANCE ASSESSMENT OF THE PRODUCTION ESTIMATION SYSTEM IN EACH CROP/REGION EXPERIMENT

#11

MULTICROP

SAMPLING AND AGGREGATION

TECHNOLOGY DEVELOPMENT

0 ISSUES

- o CRITICAL TECHNICAL SUB-COMPONENTS LACKING PROPER EMPHASIS/ COMPONENT INTEGRATION/UNDERSTANDING
  - • CHANGE ANALYSIS
  - • EARLY SEASON ESTIMATION
  - • PARTIAL RESPONSE MODELING - FACING VERY SHORT DEVELOPMENT PERIOD (FIRST YEAR)

#11

STATUS OF AgRISTARS SAMPLING FRAMES
BY WORK-STAGE

9/5/80

SAMPLING FRAME	TOTAL # OF WORK UNITS	LAST WORK STAGE COMPLETED: 1ST CARTO/ ANALYST STEPS	2ND CARTO STEP	ANALYST REVIEW	STAT REVIEW	DRAFT FINAL 1°	SUPERVISOR REVIEW
BRAZIL	78	→	→	64	14	0	0
N.C.	25	→	→	→	22	3	0
GA.	25	18	3	2	2	0	0
TOTAL	128	18	3	66	38	3	0

BRAZIL MUNICIPIO DIGITIZING: 33 OF 78 WORK UNITS COMPLETE

ARGENTINA MATERIALS: BEING ASSEMBLED

AUSTRALIA LANDSAT SEARCH: COMPLETED FOR CATALOGUED SCENES

NOTE: NEW EQUIPTMENT IS OPERATIONAL, EXCEPT FOR PLOTTER.

Prepared by: Sampling Frames and Survey Research Branch
Statistical Research Division
Economics, Statistics, and Cooperative Service
U.S. Department of Agriculture
Washington, D.C.

ATTACHMENT #12

YIELD PROJECT INTERFACE

YIELD ESTIMATE REQUIREMENTS

AREA	CROP(S)	CROP YEAR(S)
U.S.	CORN & SOYBEANS	1980
U.S.	WHEAT & BARLEY	1978 & 79
USSR	BARLEY	1976 & 1977
BRAZIL	CORN & SOYBEANS	1980-81
ARGENTINA	WHEAT, CORN, SOYBEANS	1980-81
AUSTRALIA	WHEAT	1980-81

ATTACHMENT #1

YIELD STRATA

CORN & SOYBEANS

- IOWA
  - STATE
  - CRD
  - APU
- ILLINOIS & INDIANA
  - STATE
  - CRD

BARLEY & WHEAT

- NORTH DAKOTA
  - STATE
  - CRD
  - APU
- MINNESOTA
  - STATE
  - CRD

#13

ISSUES

- DEFINITION OR DATES FOR
  - EARLY
  - MID SEASON
  - LATE
- YIELD MODEL ACCURACY GOALS
- APPROVAL OF YMD-FCPF ICD

#13

CORN AND SOYBEAN
CLASSIFICATION TECHNOLOGY DEVELOPMENT
FOR AREA ESTIMATION

FOR

FOREIGN COMMODITY PRODUCTION FORECASTING

ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN
UNIVERSITY OF CALIFORNIA AT BERKELEY
NASA, JOHNSON SPACE CENTER, SF4

FCPF SEMIANNUAL PROJECT REVIEW

24 SEPTEMBER 1980

ATTACHMENT # 14

FCPF C/S CLASSIFICATION TECHNOLOGY DEVELOPMENT FOR AREA ESTIMATION

OBJECTIVES

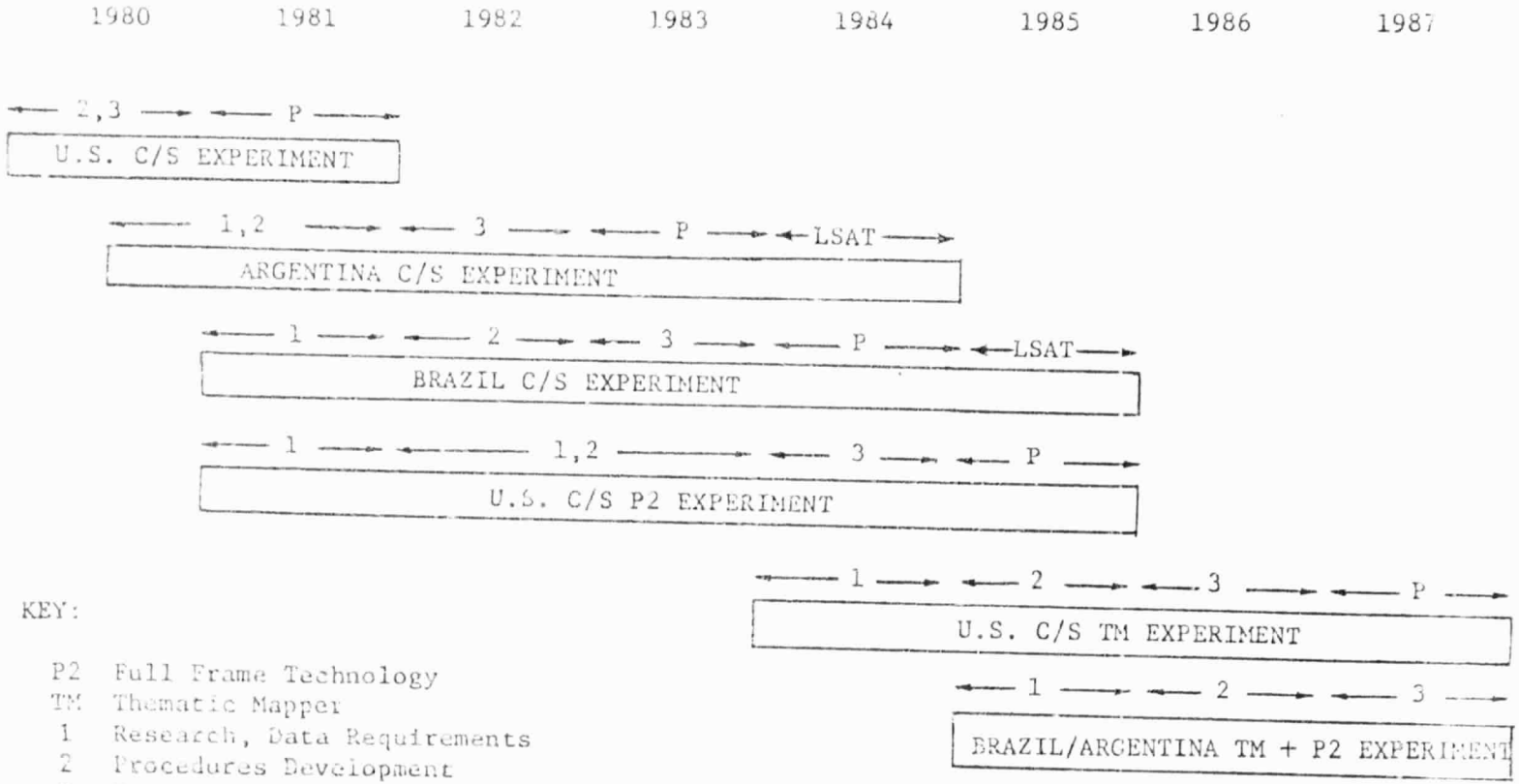
- Conduct Foreign Exploratory Experiments in Area Estimation Technology for Corn and Soybeans in Support of Pilot Experiments
- Deliver Pilot-Compatible C/S Area Estimation Procedures
- Support Pilot

#14

SCOPE OF FCPF RELATED PROGRAM

- IDENTIFY COMPONENT TECHNOLOGIES FOR CORN AND SOYBEAN AREA ESTIMATION
- ADAPT TECHNOLOGY TO FOREIGN APPLICATION
- DEVELOP END-TO-END PROCEDURES FOR EXPLORATORY EXPERIMENT TESTING
- IMPLEMENT PILOT-COMPATIBLE PROCEDURES FOR TEST AND EVALUATION
- COMPARATIVELY TEST AND EVALUATE TECHNOLOGIES
- SUPPORT SUBSEQUENT MODIFICATION AND PILOT TESTING

CORN AND SOYBEAN TECHNOLOGY PHASES

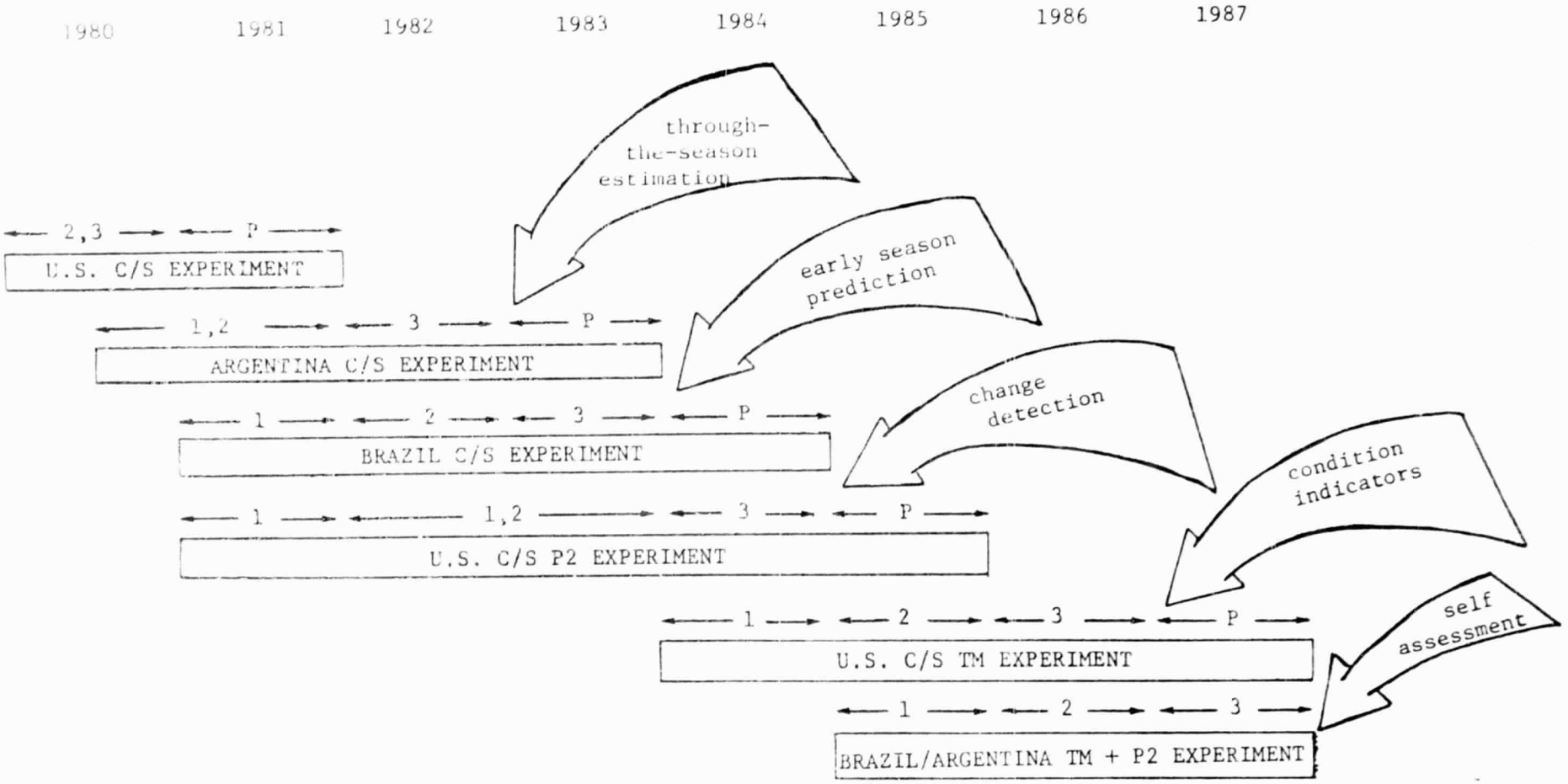


KEY:

P2	Full Frame Technology
TM	Thematic Mapper
1	Research, Data Requirements
2	Procedures Development
3	Procedures Evaluation, Modification
P	Pilot Experiment (JSC)
LSAT	Large Scale Application Test (USDA)

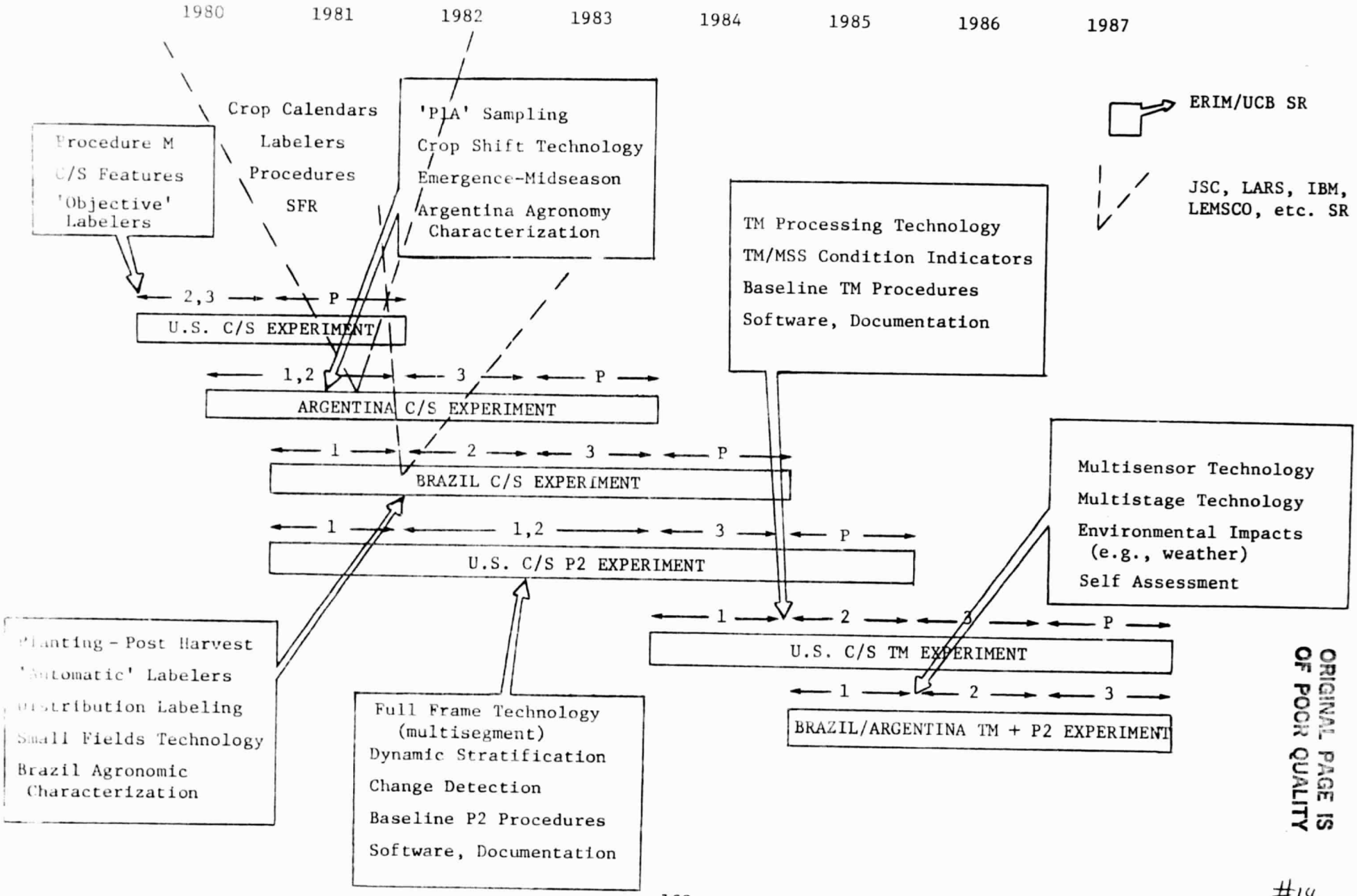
#14

MULTIPURPOSE AGRICULTURE INVENTORY



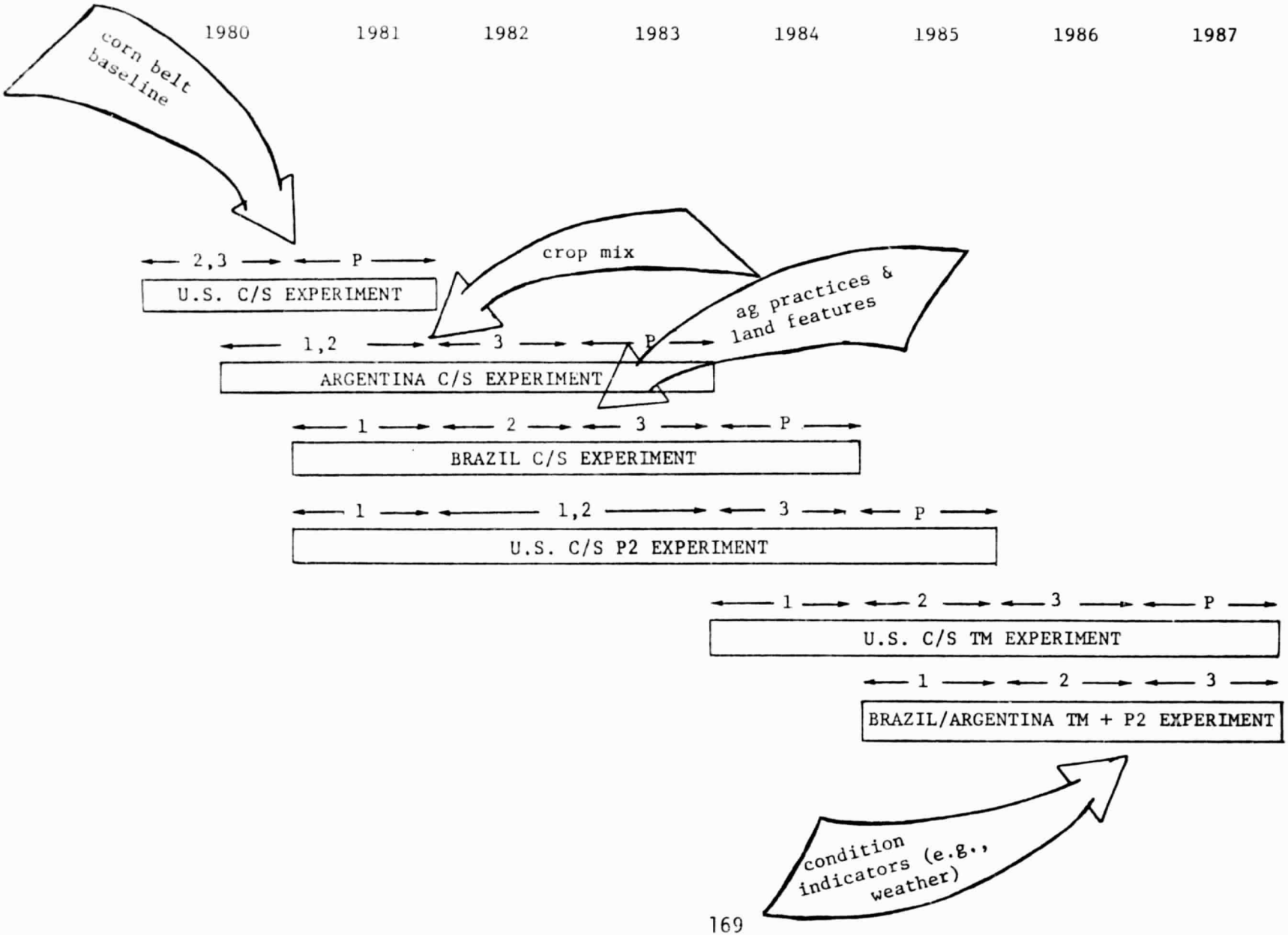
#14

SUPPORTING RESEARCH FOR CORN AND SOYBEAN FOREIGN COMMODITY PRODUCTION FORECASTING



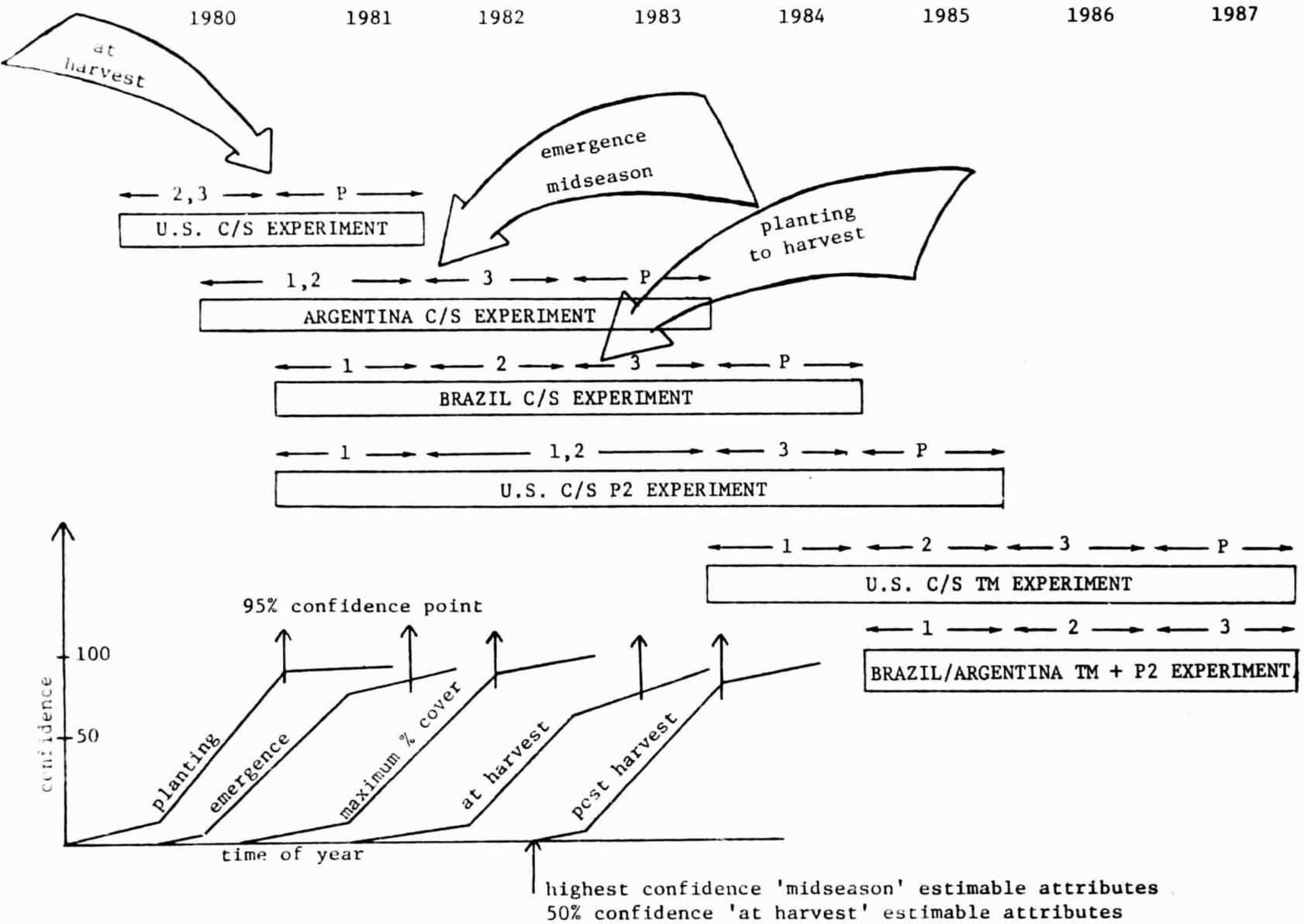
#14

FOREIGN UNDERSTANDING



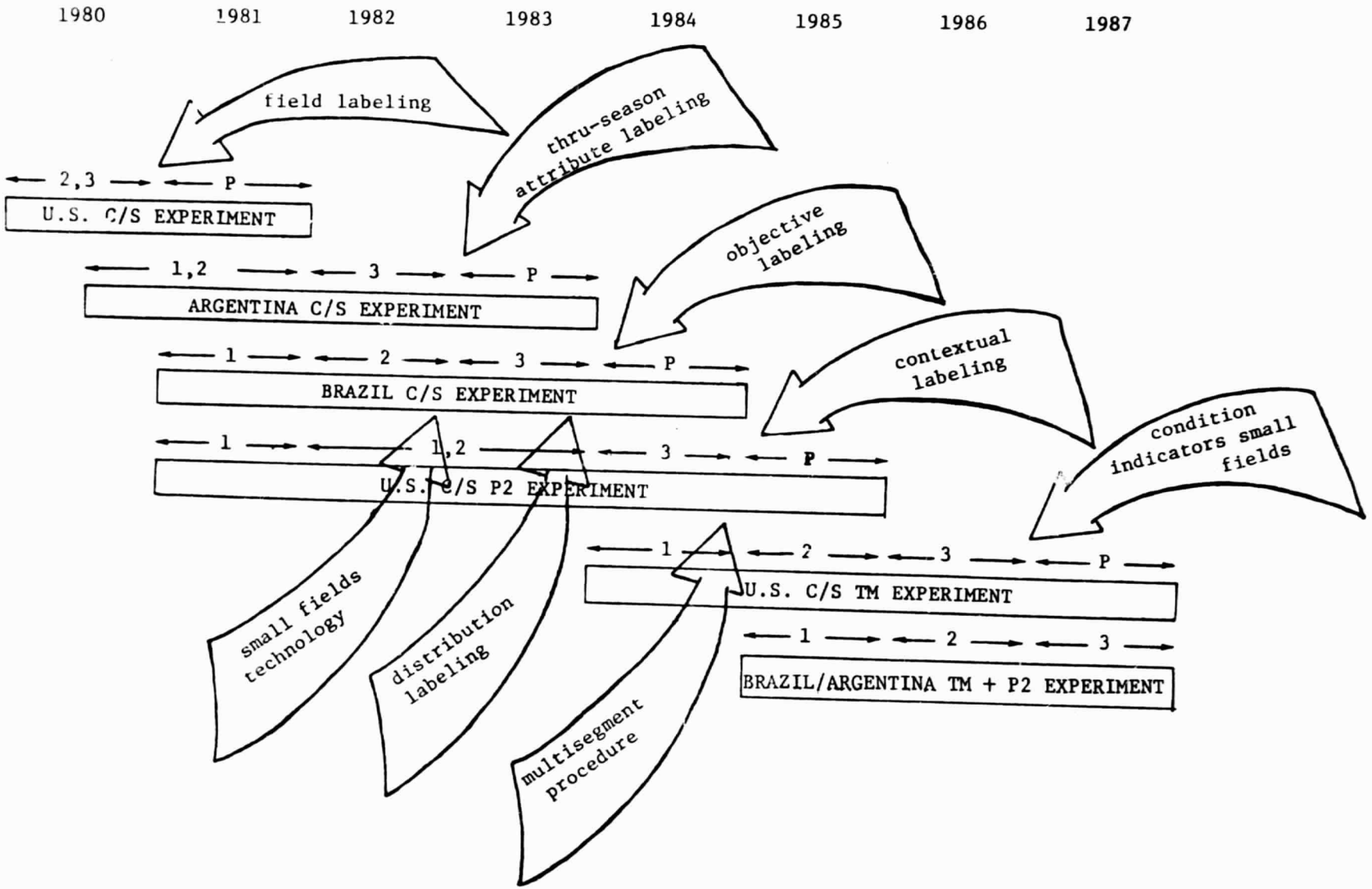
#14

THROUGH-THE-SEASON ESTIMATION



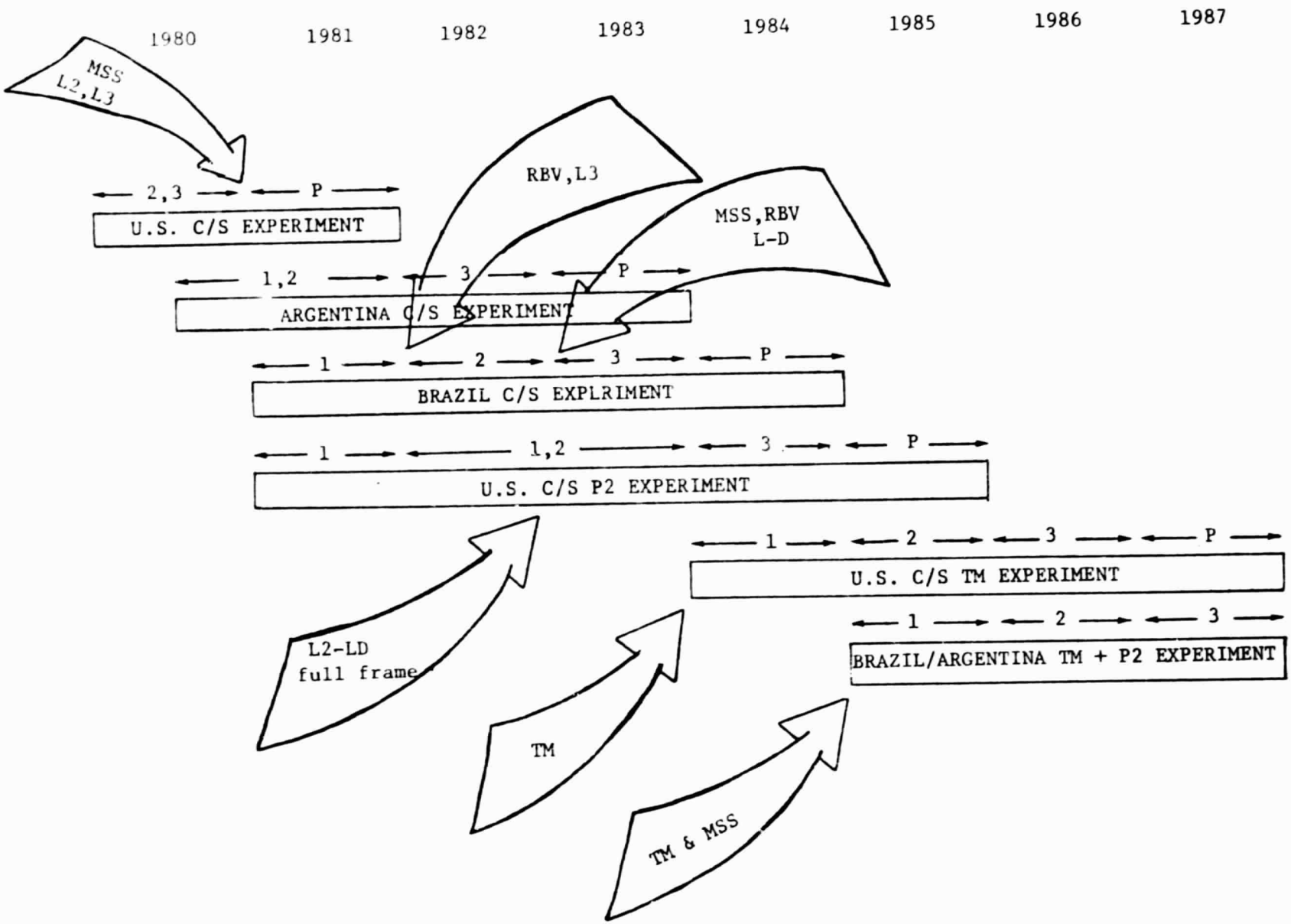
#14

CLASSIFICATION AND LABELING TECHNOLOGY



#14

SENSOR TECHNOLOGY



#14

TECHNOLOGY PHASE I

U.S. C/S CLASSIFICATION TECHNOLOGY DEVELOPMENT

TECHNICAL OBJECTIVE

- Develop and Implement Baseline Segment Classification Procedure for At-Harvest Estimates Suitable for Application in the U.S. Corn Belt

#14

FY81 U.S. C/S PILOT IMPLEMENTATION APPROACH

- Overall Implementation Managed by ERIM
- Analyst Functions Integrated by UCB
- Software Development on LARS Computer Pending Availability of ERSYS at JSC
- Existing Technology Modified and Implemented
  - Procedure M tuned for Corn/Soybeans
  - JSC Labeling Procedure adapted to field-like targets rather than dots
  - Crop Group Stratification Integrating
    - Analyst
    - Crop Calendars
    - Machine

#14

FCPF C/S CLASSIFICATION TECHNOLOGY DEVELOPMENT FOR AREA ESTIMATION*

PROJECT ELEMENT TASKS

	TASK	FISCAL YEAR	PERFORMING INSTITUTE
1.	US C/S AREA ESTIMATION PROCEDURE DESIGN	80	ERIM/UCB
2.	US C/S LABELING LOGIC DEVELOPMENT	80	UCB
3.	US C/S PROCEDURES IMPLEMENTATION	80/81	ERIM/UCB
4.	US C/S EXPLORATORY TEST AND EVALUATION	80	JSC/SF4
5.	US C/S CLASSIFICATION IN SUPPORT OF PILOT EXPERIMENT	81	JSC/SF4
6.	BRAZIL C/S AREA ESTIMATION PROCEDURE DESIGN	81	ERIM/UCB
7.	BRAZIL C/S LABELING LOGIC DEVELOPMENT	81	UCB
8.	BRAZIL C/S PROCEDURES IMPLEMENTATION	81	ERIM/UCB
9.	BRAZIL EXPLORATORY TEST AND EVALUATION	81	ERIM
10.	BRAZIL C/S CLASSIFICATION IN SUPPORT OF PILOT EXPERIMENT	82	JSC
11.	ARGENTINA C/S AREA ESTIMATION PROCEDURE DESIGN	81/82	ERIM/UCB
12.	ARGENTINA C/S LABELING LOGIC DEVELOPMENT	82	UCB/ERIM
13.	ARGENTINA C/S PROCEDURES IMPLEMENTATION	82	ERIM
14.	ARGENTINA C/S EXPLORATORY TEST AND EVALUATION	82	ERIM
15.	ARGENTINA C/S CLASSIFICATION IN SUPPORT OF PILOT EXPERIMENT	83	JSC

*Management Responsibility at ERIM

#14

ACTIVITIES AND ACCOMPLISHMENTS

(14 FEB '80 - 24 SEP '80)

GENERAL

- INITIATED AND SUPPORTED PCR TO SWITCH ORDER FOR BRAZIL AND ARGENTINA FOREIGN APPLICATIONS
- SUPPORTED DEVELOPMENT OF DRAFT PLAN FOR COOPERATIVE RESEARCH PROGRAM WITH BRAZIL
- SUPPORTED REPLANNING BY FCPF IN ANTICIPATION OF
  - TWO YEAR DELAY IN TM DATA
  - ONE YEAR GAP IN MSS DATA (P2 EXP. DELAY)

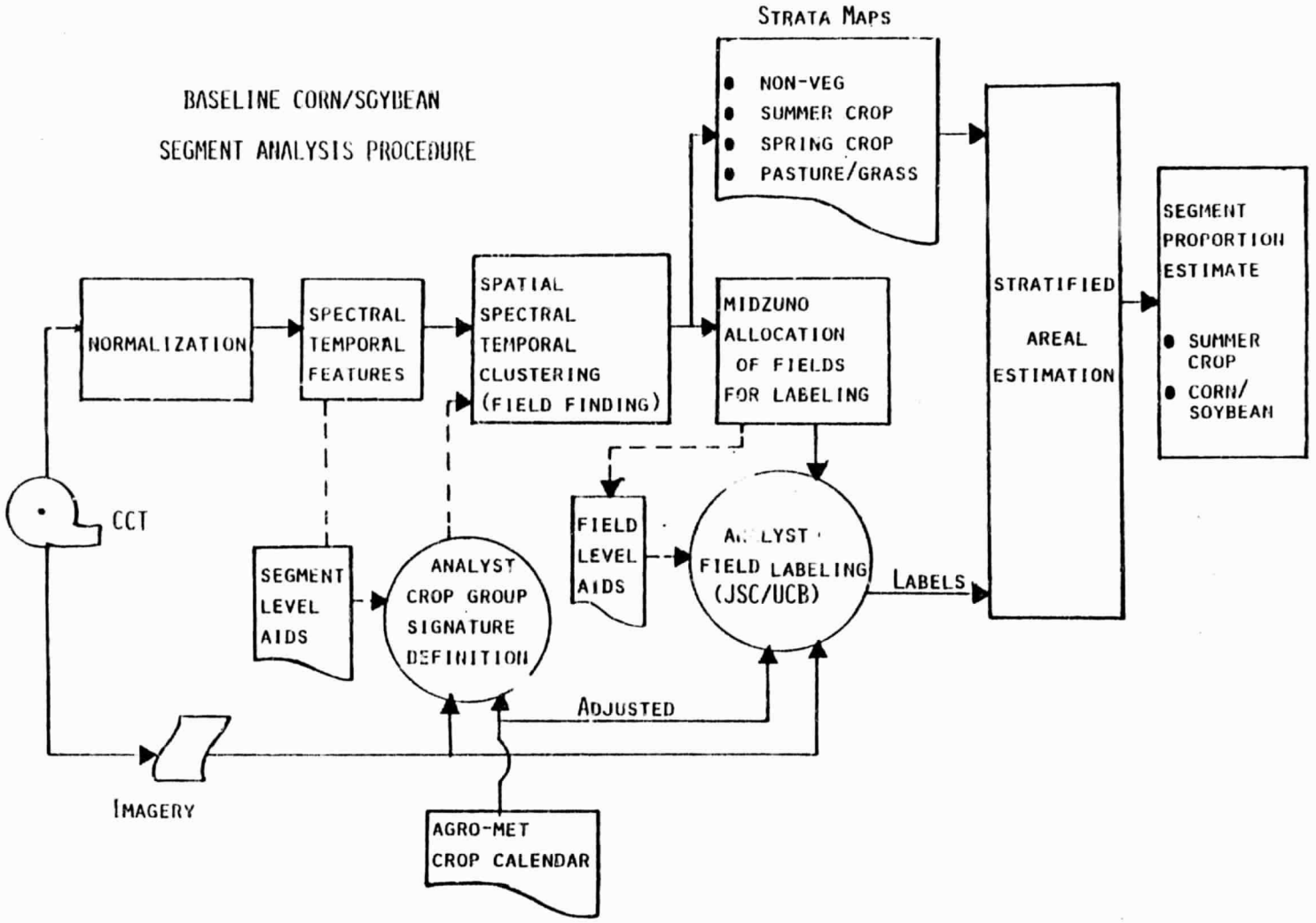
ACTIVITIES AND ACCOMPLISHMENTS (CONTINUED)

(14 FEB '80 - 24 SEP '80)

TASK 1: U.S. C/S AREA ESTIMATION PROCEDURE DESIGN

- FINALIZED C/S BASELINE PROCEDURE DESIGN AND COMPONENT SELECTION
- FINALIZED COMPONENT PARAMETER SPECIFICATION
- IDENTIFIED NEEDS FOR DEVELOPMENTAL DATA PRODUCTS FROM ACCURACY ASSESSMENT OF U.S. PILOT
- SPECIFIED COMPUTER REQUIREMENTS FOR IMPLEMENTATION

#14


BASELINE CORN/SOYBEAN
SEGMENT ANALYSIS PROCEDURE
STRATA MAPS
NON-VEG
SUMMER CROP
SPRING CROP
PASTURE/GRASS
NORMALIZATION
SPECTRAL TEMPORAL FEATURES
SPATIAL SPECTRAL TEMPORAL CLUSTERING (FIELD FINDING)
MIDZUNO ALLOCATION OF FIELDS FOR LABELING
STRATIFIED AREAL ESTIMATION
SEGMENT PROPORTION ESTIMATE
SUMMER CROP
CORN/ SOYBEAN
CCT
SEGMENT LEVEL AIDS
ANALYST CROP GROUP SIGNATURE DEFINITION
FIELD LEVEL AIDS
ANALYST FIELD LABELING (JSC/UCB)
LABELS
ADJUSTED
IMAGERY
AGRO-MET CROP CALENDAR

#14

ACTIVITIES AND ACCOMPLISHMENTS (CONTINUED)

(14 FEB '80 - 24 SEP '80)

TASK 2: U.S. C/S LABELING LOGIC DEVELOPMENT

- DEFINED CONTENTS/FORMAT FOR AI PACKET
- DEFINED REQUIREMENTS FOR CROP CALENDAR/WEATHER INTERPRETATION
- DEFINED REQUIREMENTS FOR MACHINE-GENERATED AI AIDS
- DEFINED COMPONENT PROCEDURES
  - ACQUISITION SELECTION
  - CROP GROUP STRATIFICATION (DFS)
  - LABELING LOGIC
- DEFINED OVERALL MANUAL PROCEDURE

#14

ACTIVITIES AND ACCOMPLISHMENTS (CONTINUED)

(14 FEB '80 - 24 SEP '80)

TASK 3: U.S. C/S PROCEDURES IMPLEMENTATION

- IMPLEMENTED AN ERSYS-INDEPENDENT IMPLEMENTATION APPROACH
- COMPLETED CODING AND VALIDATION OF SYSTEM SERVICES
- COMPLETED CODING AND VALIDATION OF SCENARIOS AND APPLICATION MODULES (EXCEPT AI AIDS)
- DESIGNED PILOT USERS MANUAL AND INITIATED PREPARATION OF DOCUMENTATION (MACHINE AND MANUAL PROCEDURES)
- INITIATED DEVELOPMENT OF AI TRAINING METHODOLOGY

#14

ACTIVITIES AND ACCOMPLISHMENTS (CONTINUED)

(14 FEB '80 - 24 SEP '80)

TASK 4: U.S. C/S EXPLORATORY TEST AND EVALUATION

- CONDUCTED FAMILIARIZATION TRAINING OF JSC ANALYSTS IN U.S. C/S PILOT ANALYST PROCEDURES
- SUPPORTED PROCEDURES SHAKEDOWN TEST AND EVALUATION

#14

ACTIVITIES AND ACCOMPLISHMENTS (CONTINUED)

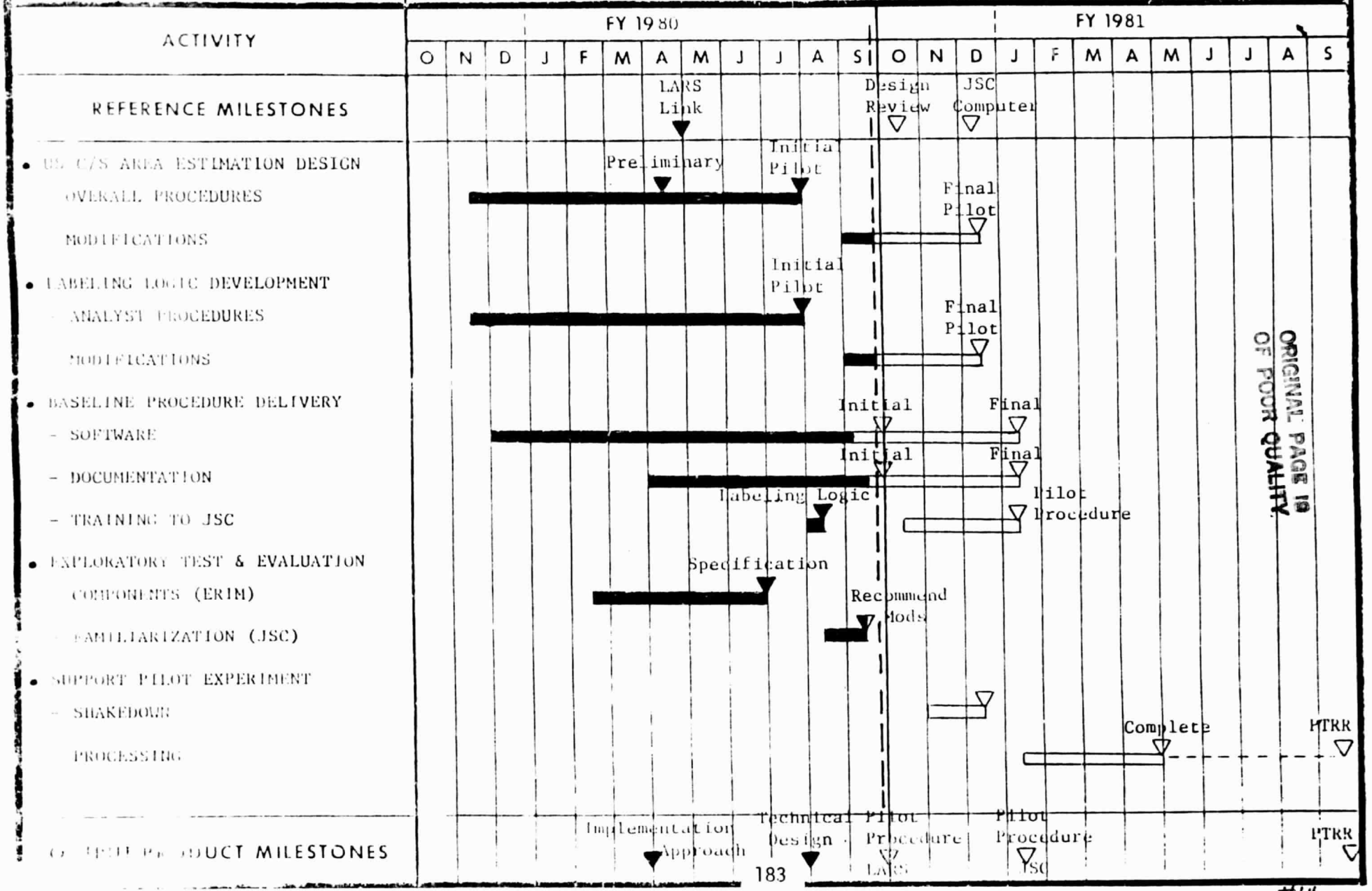
(14 FEB '80 - 24 SEP '80)

TASK 5: U.S. C/S CLASSIFICATION IN SUPPORT OF PILOT EXPERIMENT

- IDENTIFIED CANDIDATE PILOT EVALUATION FACTORS TO EXPERIMENT DESIGN
- IDENTIFIED CANDIDATE PILOT PRODUCTS TO ACCURACY ASSESSMENT
- IDENTIFIED NATURE OF SEGMENT ESTIMATES TO SAMPLING AND AGGREGATION
- PROVIDED GENERAL SUPPORT TO ABOVE PROJECT ELEMENTS

#14

REPORTING ORG./ACTIVITY:	C/S CLASSIFICATION TECHNOLOGY FOR AREA ESTIMATION U.S. TECHNOLOGY PHASE I	DATE 09/22/80 PAGE 1 OF 1



#14

NEAR TERM PLANS

(24 SEP '80 - 15 DEC '80)

GENERAL

- DEVELOP DETAILED IMPLEMENTATION PLAN FOR FY81 - FY82
- SUPPORT U.S. PILOT EXPERIMENT
  - SUPPORT CRITICAL DESIGN REVIEW OF BASELINE PROCEDURE
  - COMPLETE IMPLEMENTATION AND DOCUMENTATION
  - PROVIDE TRAINING AND SUPPORT SHAKEDOWN
  - MODIFY DOCUMENTATION AND PROCEDURES WHERE NECESSARY
- INITIATE CORN AND SOYBEAN TECHNOLOGY PHASE 2

#14

TECHNOLOGY PHASE II

ARGENTINA C/S CLASSIFICATION TECHNOLOGY DEVELOPMENT

- DEVELOP, IMPLEMENT AND EVALUATE SEGMENT CLASSIFICATION PROCEDURES FOR THROUGH-THE-SEASON ESTIMATES (EMERGENCE TO HARVEST) SUITABLE FOR APPLICATION IN ARGENTINA

#14

FCPF C/S CLASSIFICATION TECHNOLOGY DEVELOPMENT FOR AREA ESTIMATION

PLANNING UNCERTAINTIES

- NATURE OF EXPERIMENT DESIGN AND ACCURACY ASSESSMENT INTERFACES FOR ERIM-CONDUCTED EXPLORATORY T&E'S

- DEGREE AND NATURE OF ERIM INVOLVEMENT IN NASA/INPE RESEARCH AGREEMENT

FCPF C/S CLASSIFICATION TECHNOLOGY DEVELOPMENT

FOR AREA ESTIMATION

ISSUES

MSS DATA PROVISIONING

DOES NOT APPEAR TO SUPPORT

CURRENT FY81 SCHEDULES

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980—771-014/.26:40

#14